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# AN ANALYSIS OF MARINE CORPS ENLISTED PERSONNEL COHORT DATA

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## Monterey, California

# THESIS

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ENLISTED PERSONNEL COHORT DATA

by

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## ABSTRACT

Data from Marine Corps enlisted cohorts are analyzed to give insight into personnel flow through the enlisted Marine Corps system. In this paper, a cohort is a group of enlisted men who enlist in a given calendar month for a given length of obligated service. Stationarity assumptions between cohorts from different months are investigated. A major portion of the analysis is devoted to the extrapolation of the incomplete data on four-year enlistees based on the data from two-year and three-year enlistees. A prediction is made of enlisted strength for 1 January 1972 using the results of the analysis in a cohort prediction model. This is compared with the actual strength as of 1 January 1972. Refinements and associated models are suggested for further study.

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# I. THE MODEL

In this section, we formulate a model for predicting the total strength of future Marine Corps enlisted personnel. This model is based on "cohorts" of Marines (see below) and is similar to models discussed by McAfee [1] and Marshall [2].

Each Marine initially enlists in the Marine Corps for a fixed length of obligated service and begins recruit training during some month of some year along with many of his contemporaries. A group which begins recruit training in a given month and is obligated for a given length of service is called, in this paper, a cohort. If adequate records had been kept on each cohort that was initiated over the past forty years, then one could simply add up the members of each cohort that remain on active duty as enlisted men and thus determine the enlisted strength. Records have not been kept in this form, however, and the task of reconstructing them would be monumental.

Since 1966 records have been kept in cohort form. Thus, the use of a cohort model is now possible in practice even though the data is incomplete. The current state of the art in personnel forecasting together with the lack of highly detailed lifetime data do not warrant the use of a sophisticated forecasting model. The model described here is simple and assumes stationarity of cohort behavior. This assumption is investigated in Chapter III. The model parameters are determined from historical data in Chapters III and IV.

To estimate the total enlisted strength at the first of a given month N, the following model is used:

Consider monthly cohorts of men whose initial length of obligated service is two years. Let

$X_i$ = the initial total strength of the two-year cohort starting in month i.

$p(i,N;2)$ = fraction remaining at start of month N of a cohort starting in month i with a two-year obligation.

Then the expected total number of two-year obligors on active duty at the first of month N is

$$A = \sum_{i<N} X_i \, p(i,N;2). \tag{1}$$

Note that we do not include the cohort that enters in month N, since predictions are being made for the first of the month.

Similarly, let

$Y_i$ = the initial total strength of the three-year cohort starting in month i,

$Z_i$ = the initial total strenth of the four-year cohort starting in month i, and

$p(i,N;t)$ = the fraction remaining on active duty at start of month N of a cohort starting in month i with an obligated service of t years. $t = 2,3,4$.

Since each enlisted Marine initially enlists for two, three or four years, the total expected number of enlisted men at the first of month N is

$$T = \sum_{i<N} X_i p(i,N;2) + \sum_{i<N} Y_i p(i,N;3) + \sum_{i<N} Z_i p(i,N;4). \tag{2}$$

We next assume stationarity between cohorts having the same length of obligated active duty but starting in different months. That is, we assume

$$p(i,N;t) = p(N-i;t) \ , \quad t = 2,3,4 \tag{3}$$

for all i and any N. This says that for all cohorts with the same length of obligated service t, the fraction remaining on active duty k months after starting recruit training depends only on k and not on when the cohort started. Equation (2) now becomes

$$T = \sum_{i<N} X_i p(N-i;2) + \sum_{i<N} Y_i p(N-i;3) + \sum_{i<N} Z_i p(N-i;4). \tag{4}$$

In practice, the actual number of starting months included in the model would be limited to include only months when men could still be on active duty. That is, the summations in (4) would be only over i for which $p(N-i;t)$ is greater than zero.

## II. THE DATA

The data used in this thesis were provided by Headquarters Marine Corps, A01M-2. They were presented in cohort form by length of obligated active service and month of beginning recruit training. The cohorts from the six months of July through December 1967 were the most complete and were selected for the analysis.

We define a cohort member's lifetime to be the time in months from the end of his reporting month until the end of the month in which he is released from his active duty obligation or until he otherwise disassociates himself from the cohort by permanently changing his active duty status. The data provided by A01M-2 were lifetimes consistent with this definition and thus included only first-term enlistments. Although the model could be used to predict total enlisted strength, only total first-term enlistment strength is predicted because of this restriction in the data.

Each of the six cohorts of two-year obligors is traced in monthly increments for a minimum of thirty months and the three-year cohorts for a minimum of forty months, by which time over 95 percent of the lifetimes of members in each cohort have expired. The six cohorts of four-year obligors are also traced for a minimum of forty months, by which time only about 53 percent of the lifetimes of members have expired. The data from the four-year cohorts are, therefore, incomplete and missing data must be estimated (Chapter IV).

In the original data from Headquarters Marine Corps, completed lifetimes for each month traced are divided into five separate groups as follows:

R1 - Separated altogether from the Marine Corps usually for mental, physical or disciplinary reasons.

R2 - Re-enlistment, leaves cohort by changing length of obligated service.

R3 - Released from active duty, transferred to Marine Corps Reserves.

R4 - Dropped as a deserter.

R5 - Accepted as an Officer Candidate, leaves cohort by changing status.

Table I gives an example of the cohort data for two-year obligors starting in October 1967. The complete data base is given in Appendix A.

Groups R2, R4 and R5 amount to a very small percentage of any given cohort and hence, for analysis purposes these are grouped together with R1 to form two basic categories of lifetimes:

a) Attrition - Cohort members who for various reasons do not complete their tour of active duty as originally obligated. (R1 + R2 + R4 + R5).

b) EOAS - End of Obligated Active duty Service. Members who complete their active duty obligation to the satisfaction of the Marine Corps and are transferred to the Reserves. (R3).

The term Total Data is used when referring to the combination of Attrition and EOAS, i.e., to all the members of a cohort.

TABLE I

Example of Cohort Data
Two-year obligors, starting in October 1967

Initial Strength = 2034

| Month after start | Losses by Groups R1 | R2 | R3 | R4 | R5 | Row Total | Number Remaining |
|---|---|---|---|---|---|---|---|
| 1 | 38 | | | | | 38 | 1996 |
| 2 | 35 | | | 1 | | 36 | 1960 |
| 3 | 15 | | | | | 15 | 1945 |
| 4 | 10 | | | | | 10 | 1935 |
| 5 | 5 | | | | | 5 | 1930 |
| 6 | 10 | | | 1 | | 11 | 1919 |
| 7 | 32 | | | | 3 | 35 | 1884 |
| 8 | 20 | | | | | 20 | 1864 |
| 9 | 10 | | | | | 10 | 1854 |
| 10 | 22 | | | | 8 | 30 | 1824 |
| 11 | 10 | | | | | 10 | 1814 |
| 12 | 13 | | | 1 | 1 | 15 | 1799 |
| 13 | 10 | 1 | | | | 11 | 1788 |
| 14 | 10 | 1 | | 1 | | 12 | 1776 |
| 15 | 14 | | | 1 | | 15 | 1761 |
| 16 | 12 | 1 | 5 | 1 | 1 | 20 | 1741 |
| 17 | 19 | 2 | 10 | | | 31 | 1710 |
| 18 | 14 | 2 | 73 | 1 | 1 | 91 | 1619 |
| 19 | 18 | | 376 | | | 394 | 1225 |
| 20 | 5 | 1 | 205 | | | 211 | 1014 |
| 21 | 9 | 2 | 72 | 1 | | 84 | 930 |
| 22 | 17 | 6 | 110 | 2 | | 135 | 795 |
| 23 | 16 | 1 | 137 | | | 154 | 641 |
| 24 | 17 | 5 | 432 | | | 454 | 187 |
| 25 | 13 | | 33 | | | 46 | 141 |
| 26 | 7 | | 17 | | | 24 | 117 |
| 27 | 3 | | 18 | 1 | | 22 | 95 |
| 28 | 3 | | 3 | 1 | | 7 | 88 |
| 29 | 5 | | 6 | | | 11 | 77 |
| 30 | 7 | | 2 | | | 9 | 68 |
| 31 | 2 | | 0 | | | 2 | 66 |
| 32 | 6 | | 2 | | | 8 | 58 |
| 33 | 3 | | 2 | | | 5 | 53 |
| 34 | 2 | | 1 | | | 3 | 50 |
| 35 | 1 | | 4 | | | 5 | 45 |
| 36 | 0 | 1 | 5 | | | 6 | 39 |
| Total Losses | 433 | 23 | 1513 | 12 | 14 | 1995 | |

# III. <u>THE ANALYSIS</u>

## A. PURPOSE

The purpose of analyzing the past lifetime distributions of enlisted cohorts is first to determine if the stationarity assumption (Chapter I) is reasonable. Secondly, the analysis yields values for the model parameters $p(k;t)$, $k < N$, $t = 2,3,4$.

## B. STATIONARITY

All cohorts with the same length of obligated active duty are considered together and called a <u>grouping</u>. Each cohort grouping is treated separately during this first portion of the analysis. Using the Total Data (Attrition plus EOAS), the fraction of a cohort whose lifetimes exceed a given number of months (survivor function) was plotted for each cohort and mean lifetimes calculated. Thirty-month means for the two-year cohorts and forty-month means for the three and four-year cohorts are plotted in Figure 1. No significant trends are obvious and the maximum difference between any two means within a grouping is less than five percent of the aggregate mean. Since more complete data are available on two-year cohorts, the thirty-month means of the January through June 1968 cohorts were also computed and plotted. These additional values remained within five percent of the aggregate mean and indicated no obvious trends.

The values of the four-year cohorts' forty-month means are not representative of the true mean of a four year cohort because only some 53 percent of the lifetimes are represented. However, the small variation within which the values fell at this common cut-off time

and the similar shapes displayed by the three curves in Figure 1 indicate that though these estimated means are numerically low, the true means would follow these estimates and hence would show no obvious trends.

The mean lifetimes of the cohorts, therefore, appear to be constant over time within groupings. This tends to support the stationarity assumption.

Next, the aggregate survivor function of all six cohorts was calculated for each grouping. These are plotted within the envelopes formed by extreme values of their six component survivor functions. (Figure 2).

If it is assumed that all the individual members of each cohort act independently, and if $S_j$ is the number in a cohort of size n whose lifetimes exceed j months, then under the hypothesis of stationarity $S_j$ would be a binomially distributed random variable with parameters n and $\pi_j$, where $\pi_j$ = Prob [an individual lifetime exceeds j months]. In this case the variance of $S_j$ is $n\pi_j(1-\pi_j)$, and

$$\mathrm{Var}\left[\frac{S_j}{n}\right] = \frac{1}{n^2}\ \mathrm{Var}\left[S_j\right] = \frac{\pi_j(1-\pi_j)}{n} . \qquad (5)$$

The maximum value that $\pi_j(1-\pi_j)$ can be is 0.25 when $\pi_j = 0.5$ and thus

$$\mathrm{Var}\left[\frac{S_j}{n}\right] \le \frac{0.25}{n} .$$

The maximum variances for the three Total Data aggregate sample tail distributions (survivor functions) under the stationarity and independence hypotheses are displayed in Table II below.

Table II

Maximum Variances for Total Data Aggregate Distributions

| Grouping | Sample Size (n) | Max Variance ($\sigma^2$) | $2\sigma$ |
|---|---|---|---|
| 2-year | 11728 | $.213 \times 10^{-4}$ | .00923 |
| 3-year | 8849 | $.282 \times 10^{-4}$ | .01063 |
| 4-year | 21122 | $.118 \times 10^{-4}$ | .00688 |

It must be concluded that either the stationarity or independence assumption (or both) does not hold. Clearly, individual members do not act independently with regard to leaving active duty. Since all the men follow very similar career patterns during their first term and are all subject to the same perils and policies, they can be expected to act in similar ways.

The six component sample distributions of each grouping were plotted on the same graph in order to further investigate the stationarity assumption. The distributions crossed each other several times and indicated no clear trends. The distributions for the cohorts of July, September and November are plotted for each of the three groupings in Figures 3, 4 and 5 for the two-year, three-year and four-year groupings respectively. These plots also tend to support the stationarity assumption.

## C. INHOMOGENEITY IN COHORTS

For further insight into the cohort behavior, the Total Data of each cohort are split into the two basic categories of Attrition and EOAS (Chapter II). The distributions of each category within each grouping are plotted and investigated for stationarity as was done on the Total Data.

With only 53 percent of the lifetimes of four-year obligors completed, it is not known what fraction of a given four-year cohort will eventually fall into each of the two categories, Attrition and EOAS. It is, therefore, necessary to determine estimates for these fractions. This is done in the following manner using the data from the aggregate distributions: Let

$Z$ = the active duty lifetime of a four-year enlistee.

$Z_1$ = the active duty lifetime of a four-year enlistee given that he will fall in the EOAS category.

$Z_2$ = the active duty lifetime of a four-year enlistee given that he will fall in the Attrition category.

$p_1$ = the probability that a four-year enlistee will fall in the EOAS category.

$p_2$ = the probability that a four-year enlistee will fall in the Attrition category. $(1-p_1)$.

Then the following relations hold:

$$P\,[Z \le z] = p_1 P\,[Z_1 \le z] + p_2 P\,[Z_2 \le z]\ , \tag{6}$$

$$P\,[Z \le z] = 1 - P\,[Z > z]\ , \tag{7}$$

where $P[Z > z]$ are the values plotted in the lifetime tail distribution (Figure 2, four-year curve). The values $p_1$ and $p_2$ will be determined as the estimates of the desired fractions.

From the data - and subsequently from the four-year plot in Figure 7 - it can be seen that for values of $z \le 28$ the number of EOAS losses is negligible. Therefore, we take $P\,[Z_1 \le 28] = 0$. For $z = 28$, equation (6) reduces to

$$P\,[Z \le 28] = p_2\ \ P\,[Z_2 \le 28]\ . \tag{8}$$

From the data, or from Figure 2 (four-year aggregate curves), the left-hand side of (8) is 0.215. The Attrition probability, $P[Z_2 \leq 28]$, now needs to be determined so that $p_2$ can be estimated.

It is noted that the aggregate Attrition distributions for the two-year and three-year groupings (Figure 6) are remarkably linear out to their original obligated service of 24 and 36 months respectively. It is reasonable to believe, therefore, that the four-year aggregate Attrition distribution will follow a similar linear function. From the values of the two-year and three-year distributions at 24 and 36 months respectively, it is hypothesized that the four-year aggregate Attrition distribution will be approximately linear from its beginning value of 1.0 at zero months to a value of 0.03 at 48 months.

Using this linear approximation, the value of $P\,[Z_2 \leq 28]$ is 0.566. Hence, from equation (8),

$$p_2 = \frac{P\,[Z \leq 28]}{P\,[Z_2 \leq 28]} = \frac{0.215}{0.566} = 0.380 \ . \tag{9}$$

With a total four-year aggregate sample size of 21,122 Marines, it follows that 8032 Marines will be in the Attrition category and 13,090 will be in the EOAS category.

Based on a sample size of 8032, the forty-month data produced another remarkably linear Attrition distribution (Figure 6, four-year curve) as hypothesized. Note that a change in the sample size affects only the slope of this curve and not its linearity. The four-year EOAS distribution using the sample size of 13,090 is plotted in Figure 7 (four-year curve).

The value of $p_2 = 0.380$ is also used to determine the expected sample sizes of the two basic categories for the component distributions.

To investigate the Attrition and EOAS category distributions for stationarity, procedures similar to those used for the Total Data are followed. Essentially, each cohort is divided into two sub-cohorts, one for each of the two basic categories.

The tail distributions (survivor functions) were determined for each sub-cohort. The mean lifetimes calculated for these distributions are plotted for the Attrition and EOAS categories in Figures 8 and 9 respectively. The EOAS means (Figure 9) show a slight upward trend for the four-year sub-cohorts and no clear trends for the two-year and three-year sub-cohorts. The maximum difference in each grouping is again less than five percent of the aggregate mean.

The Attrition means (Figure 8), however, show a distinctive upward trend for the three-year sub-cohorts. No obvious trends are indicated in the two-year and four-year sub-cohorts, but the maximum difference in all three groupings exceeds five percent of the individual aggregate mean, and the differences within the three-year and four-year groupings exceed ten percent.

The mean lifetimes of the Attrition sub-cohorts, therefore, cannot be assumed to be constant over time within groupings, and thus do not support the stationarity assumption.

The aggregate Attrition distribution for each grouping was calculated and these are plotted within their envelopes of extreme component values (Figure 6). Under the stationarity and independence hypotheses (page 13), the maximum variances for the three Attrition aggregate sample tail distributions are as shown in Table III.

Table III

Maximum Variances for Attrition Aggregate Distributions

| Grouping | Sample Size (n) | Max Variance ($\sigma^2 = \frac{.25}{n}$) | $2\sigma$ |
|---|---|---|---|
| 2-year | 2803 | $.812 \times 10^{-4}$ | .0189 |
| 3-year | 2610 | $.958 \times 10^{-4}$ | .0196 |
| 4-year | 8032 | $.311 \times 10^{-4}$ | .0111 |

Similarly the EOAS aggregate distributions were calculated and are plotted within their envelopes in Figure 7. The maximum variances for the three EOAS aggregate sample tail distributions under the hypotheses of stationarity and independence are shown in Table IV.

Table IV

Maximum Variances for EOAS Aggregate Distributions

| Grouping | Sample Size (n) | Max Variance ($\sigma^2$) | $2\sigma$ |
|---|---|---|---|
| 2-year | 9167 | $.273 \times 10^{-4}$ | .0104 |
| 3-year | 6239 | $.401 \times 10^{-4}$ | .0127 |
| 4-year | 13090 | $.191 \times 10^{-4}$ | .0087 |

As with the maximum Total Data variances in Table II, these values are too small to plot on Figures 6 and 7. Again, it must be concluded that either the stationarity or independence assumption (or both) does not hold.

Within each category and grouping, the six component monthly sub-cohort distributions were plotted on the same graph to further

investigate the stationarity assumptions. Trends similar to those indicated by the plots of the means (Figures 8 and 9) were revealed tending to discount the stationarity assumption especially for the Attrition distributions. The sub-cohort distributions for July, September and November are plotted for each category and grouping in Figures 10 through 15.

It is therefore concluded that since the Attrition data do not appear to be stationary, we should not attempt to apply the data in category form to this model. However, for purposes of the model, it is felt that the Total Data can be considered as being stationary within groupings by length of initial obligated active duty service.

D. PARAMETER ESTIMATION

We assume, from the above analysis, that the Total Data distributions are stationary within groupings. Therefore, the Total Data aggergate distributions should give reasonably accurate estimates for the model parameters $p(k;t)$, $t = 2,3,4$ out to their plotted limits of $k = 30$, 40 and 40 months for $t = 2,3$ and 4 respectively.

Sufficient data are not available on lifetimes longer than 36 months for the two-year cohorts[1], and 40 months for the three-year and four-year cohorts. Assuming lifetimes ended at these points, or $p(k;2) = 0$, $k \geq 37$, and $p(k;3) = p(k;4) = 0$, $k \geq 41$, would lead to low estimates in our predictions. Therefore the parameters in these ranges are estimated in the following way.

---

[1]For all six two-year cohorts, data is available only to $k = 30$ months. However, for five of the six cohorts data is available to $k = 36$ and the parameters $p(k;2)$, $k = 31,\ldots,36$ are determined from this reduced sample aggregate distribution.

The distributions of the two-year aggregate data beyond 24 months and the three-year aggregate data beyond 36 months appear to have geometric tails (Figure 2). In other words, after the initial length of obligated service, the lifetimes of remaining members appear to be distributed geometrically. In the two-year case, therefore, a geometric distribution is fitted to the data from p(24;2) through p(36;2) and extended to provide the missing parameters p(k;2), $k \geq 37$. These parameters are obtained by solving

$$p(k;2) = p(36;2)\, q_2^{k-36}, \quad k \geq 37, \tag{10}$$

where $p_2 = (1 - q_2)$ is the parameter of the fitted geometric distribution.

In the three-year case, a geometric distribution is fitted that extends the aggregate curve from p(40;3) through a selected value of p(48;3) = .018, which is consistent with the corresponding two-year parameter p(36;2). Since p(40;3) is known from the data, the geometric parameter $q_3$ for this fit can easily be calculated from

$$p(48;3) = p(40;3)\, q_3^{8}\, . \tag{11}$$

The remaining three-year parameters are then determined by

$$p(j;3) = p(40;3)\, q_3^{j-40}, \quad j \geq 41 \tag{12}$$

The extrapolations involved in obtaining values for p(k;4), $k \geq 41$, are much more difficult and are discussed in Chapter IV.

## IV. THE EXTRAPOLATION

The cohort data reports used as a basis for parameter extimation were last updated as of April 1971. At that point, the four-year cohorts selected had been traced for a minimum of 40 of their original 48 month obligations. Therefore, only about 53 percent of the members' lifetimes had expired. Due to reporting delays, processing time and the expense involved in obtaining the data in the desired cohort form, the lifetime distributions beyond 40 months are not available at the time of this study. In this chapter a method is proposed for estimating the desired parameters $p(k;4)$, $k \geq 41$.

From visual inspection of Figure 2, marked similarities can be seen between the two-year and three-year Total Data aggregate life distributions. Because the four-year life distributions appear also to be following a similar pattern, it is hypothesized that a relatively simple relationship can be found that will reasonably describe the four-year distribution at least up to 48 months based on the two-year or three-year distribution already plotted. After the obligated 48 months, a geometric tail can be added similar to that on the three-year distribution (Chapter III).

Relationships are established between two different aggregate lifetime distributions plotted on the same axes as follows:

Let $X$ = lifetime of two-year (or three-year) enlistees

$Z$ = lifetime of four-year enlistees

$f$ = a one-to-one function relating $X$ and $Z$

then $Z = f(X)$ with $X = f^{-1}(Z)$.

Now

$$\{Z > z\} \Leftrightarrow \{f(X) > z\} \Leftrightarrow \{X > f^{-1}(z)\}\ , \tag{13}$$

and hence

$$P[Z > z] = P[X > f^{-1}(z)]. \tag{14}$$

Now if $\overline{F}(x) = P[X > x]$, the tail distribution of X,

and $\overline{G}(z) = P[Z > z]$, the tail distribution of Z,

then equation (14) can be written as

$$\overline{G}(z) = \overline{F}(f^{-1}(z)), \tag{15}$$

or

$$\overline{G}(f(z)) = \overline{F}(z). \tag{16}$$

Values of f(z) up to 40 months are determined (for example, see Figure 16) and in each case (2 yr. vs. 4 yr. and 3 yr. vs. 4 yr.) are plotted against z (Figure 17). Since it is also known from experience and from the two-year and three-year distributions that over 90 percent of the lifetimes have expired at the end of the initial obligated time, appropriate weighting points are plotted at f(z) = 48 months.

By polynomial regression techniques, linear and quadratic functions were fitted to the plotted points (Figure 17). These methods yielded best least-squares approximations of the desired function f(z), which are listed in Table V below. Using these functions, the values of z are obtained for f(z) = 41,..., 48 months. Hence $\overline{G}(f(z))$, which is equal to $\overline{F}(z)$, can be plotted for f(z) = 41, ..., 48.

TABLE V

Polynomial Regression Results

| Comparison | Degree of Regression | Functional Relationship f(z) |
|---|---|---|
| 2 yr. vs. 4 yr. | First (Linear) | $3.65z - 37.6$ |
| | Second | $15.45z - .29z^2 - 154.02$ |
| 3 yr. vs. 4 yr. | First (Linear) | $1.7z - 12.35$ |
| | Second | $4.58z - .05z^2 - 53.9$ |

The best fit appeared to be a second-degree polynomial relating the Total Data aggregate distributions of the two-year and four-year cohorts (see Figure 18). This function extrapolates the four-year Total Data distribution out to approximately 50 months. (The sensitivity of this extrapolation is discussed in Chapter V.) A geometric tail is then fitted extending the extrapolation through $p(60;4) = .018$. The monthly values of this extrapolation curve are used as the estimates of the parameters $p(k;4)$, $k \geq 41$ in the model described in Chapter I.

## V. THE PREDICTION RESULTS

### A. PREDICTION

In order to predict the total enlisted strength at the start of a given month, we need to know the fractions p(k;t) defined on page 8. The Data available to us for this thesis, however, are sufficient only to determine the total First-term enlisted strength. Except for the incomplete data on first re-enlistments (R4, Chapter II), information on re-enlistments and careerists is not included. Thus, in this chapter, we predict the total number of First-termers on active duty in the Marine Corps as of 1 January 1972, using the model parameters estimated in Chapters III and IV.

Headquarters Marine Corps, A01M-2, has furnished the initial total strengths $X_i$, $Y_i$ and $Z_i$ for the two-year, three-year and four-year cohorts respectively for the 60 starting months between January 1967 and December 1971.

To obtain the number of those members still on active duty as of 1 January 1972 and still in their first enlistment, we enter the given cohort strengths along with the parameter estimates p(k;t), k = 1,..., 60, t = 2,3,4, into the model described in Chapter I. Since cohort initial strengths are not known for k ≥ 61, we estimate the number of First-termers remaining on active duty from those cohorts by

$$C_t \, p(60;t) \frac{q_t}{1-q_t} , \quad t = 2,3,4 , \tag{17}$$

where $C_t$ = the average of the initial cohort strengths over k = 49, ..., 60 for each grouping (t),

$p(60;t)$ = the fraction of a t-year cohort remaining on active duty at the end of 60 months,

$q_t = (1 - p_t)$ and $p_t$ is the parameter of the geometric tail distribution fitted to the t-year aggregate curve.

These estimates are simply the remainder of the geometric distributions after 60 months applied to representative average cohort sizes for each grouping.

Incorporating these estimates into the model we obtain the results tabulated in Table VI.

TABLE VI

Model Prediction Results for 1 Jan. 1972

| Enlistment Contract | Number on Active Duty |
|---|---|
| 2 Years | 34,797 |
| 3 Years | 24,529 |
| 4 Years | 73,864 |
| Total First-termers | 133,190 |

Headquarters Marine Corps also provided two other figures:

1) The total enlisted strength as of 1 January 1972 = 175,683 Marines.

2) The number of Marines serving on their second or subsequent enlistment as of 1 January 1972 = 38,753.

These figures imply that the total number of First-termers on active duty as of 1 January 1972 should be 136,930. If this number is indeed correct, then the model is predicting low by 3740 Marines or slightly over two percent of the total force. The model predicts that 75.81 percent of the total enlisted force are First-termers as compared with 77.94 percent derived from the reported figures.

## B. EXTRAPOLATION SENSITIVITY

An important factor that contributes to the prediction accuracy is the extrapolation of the four-year aggregate survivor function from 40 to 48 months as described in Chapter IV. We therefore investigate the sensitivity of the prediction results to changes in the extrapolation curve. To do this, three alternative distributions are fitted from p(40;4) to p(48;4) as follows:

1) Linear - a straight line connection representing a constant number of losses per month,

2) Free Hand - an approximation to the distribution based on experience, intuition and a few incomplete reduced samples, and

3) Upper Bound - a horizontal straight line out to the 48th month representing no further losses until that month.

These alternatives are plotted in Figure 19 along with the extrapolation distribution from Chapter IV. New values of the parameters p(k;4), k = 41, ..., 47 were determined for each alternative and their representative changes in the prediction calculated. These changes in numbers of men and in percent of total force are shown in Table VII.

TABLE VII

Extrapolation Sensitivity Results

| Alternative | Prediction Change | Change in Percent of Total Force |
|---|---|---|
| Linear | - 1166 | - 0.66 |
| Free Hand | + 901 | + 0.51 |
| Upper Bound | + 2471 | + 1.41 |

These results indicate that the final prediction of the model is relatively insensitive to the extrapolation techniques applied. Although having complete data for parameter estimation is still desireable, satisfactory estimates can be made using any reasonable technique of extrapolation.

## VI. SUMMARY AND CONCLUSIONS

The model in this paper is simple and for computational purposes relies heavily on the assumption that cohort behavior is stationary over time. The more data that are available, of course, the easier it is to support or discount the stationarity assumption. Also, more confidence can be placed in the parameter estimates and, hence, in the prediction results as long as the stationarity assumption is assumed. It is felt that complete data on cohorts of the full twelve months of a year, each traced up to a minimum of one year past the initial length of obligated service is a minimum requirement for a useful data base with which to make good parameter estimates and strength forecasts.

The data analyzed for this model appear to be reliable with the possible exception of the deserter data (R4, Chapter II, Table I). For purposes of the Model, the deserter data are good, but they can be misleading if not handled consistently when making comparisons with figures from other sources. If in the latest update of a given cohort a deserter is still unaccounted for, then he appears in the data as an expired lifetime during the month he deserted. If in a subsequent update he is apprehended and returned to service for disciplinary action, he is re-entered into his original cohort and no evidence remains in the data that he was missing. On 1 January 1972, how many deserters were at large, not counted in the total strength figure and will yet be returned to service?

Any forecasting method involving many parameters which must be estimated is subject to random errors and problems with data definitions

and interpretations. It is felt that for a first pass prediction using incomplete data and crude extrapolation techniques, the results indicate considerable potential for this type of model.

## VII. USES AND FURTHER STUDY

The ultimate use of this type of model is to predict total enlisted strength at some future date. To do this, the refined First-termers model discussed in Chapter VI would have to be combined with a similar model for Careerists based on re-enlistment data. Together, these two models would comprise a means of forecasting the total enlisted force of the Marine Corps. By knowing the desired force level at some distant time, say 1 January 1974, these models could be manipulated to yield suggested monthly inputs for the interim months.

Cohort models are not restricted to enlisted data, of course. Models for Officer cohorts such as described in McAfee [1] can also be useful in the same manner.

Major Marine Corps policy changes can have a significant effect on changing the shape of the cohort survivor functions and thereby changing the required model parameters. Effects of such policies as early outs or involuntary extensions could be analyzed through a cohort model by postulating life distributions as functions of the policy variables (fractions let out early, fraction extended, etc.).

Other possible areas for further study using cohort data similar to that analyzed for this paper include: effect of casualties due to hostile action on cohort attrition, survivor functions for draftees compared to volunteers, effects of deserters on total strength, and analysis of lifetimes by mental groupings.

Also, with more complete data, reasonable bounds on parameters for the model presented could be found, thus yielding a prediction range as well as a best estimate.

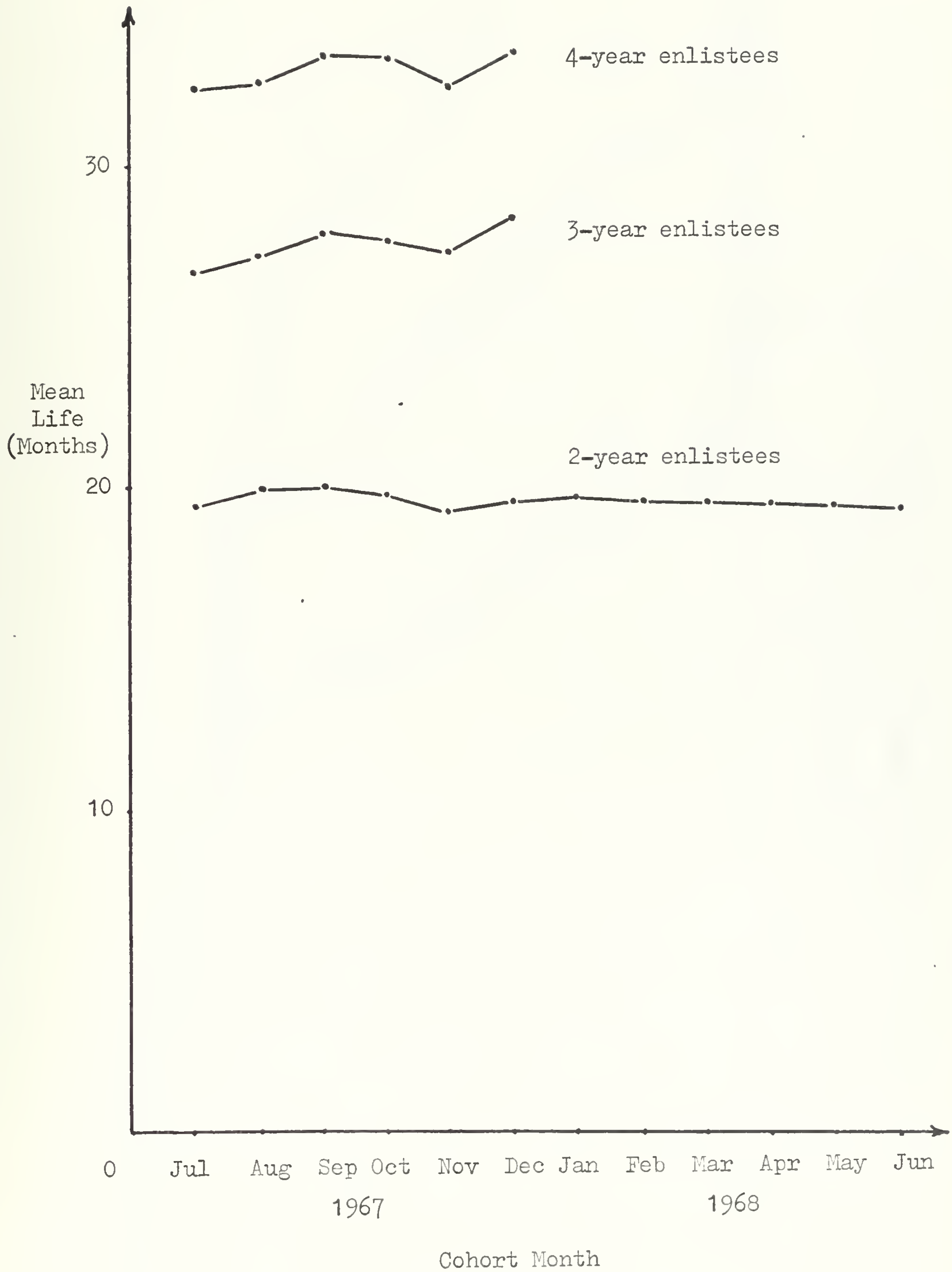


Figure 1: Total Data Mean Lifetimes

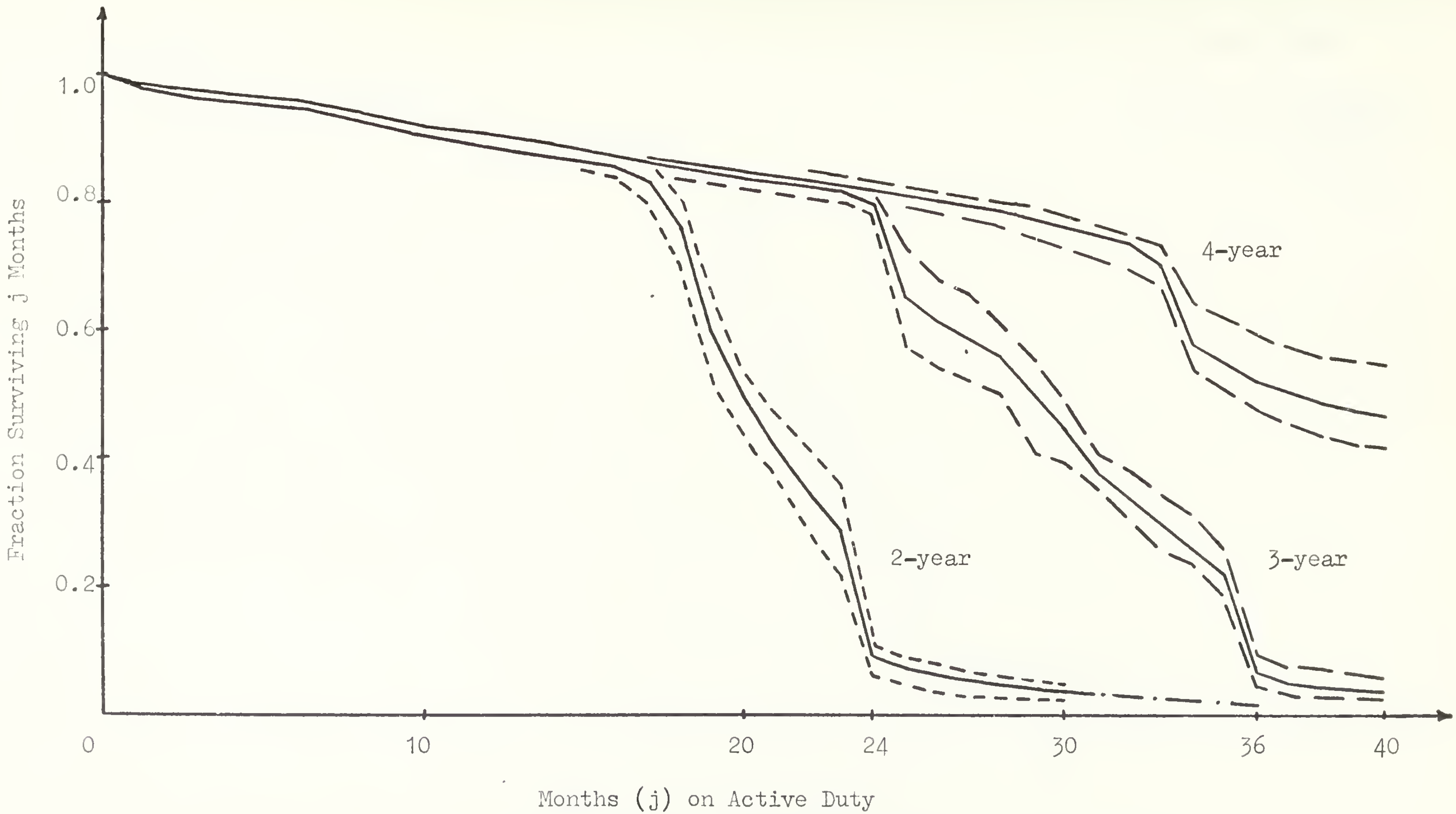


Figure 2: Total Data Aggregate Survivor Functions with Envelopes


Figure 3: Distributions for Two-year Total Data Cohorts, July, September, November 1967


Figure 4: Distributions for Three-year Total Data Cohorts, July, September, November 1967

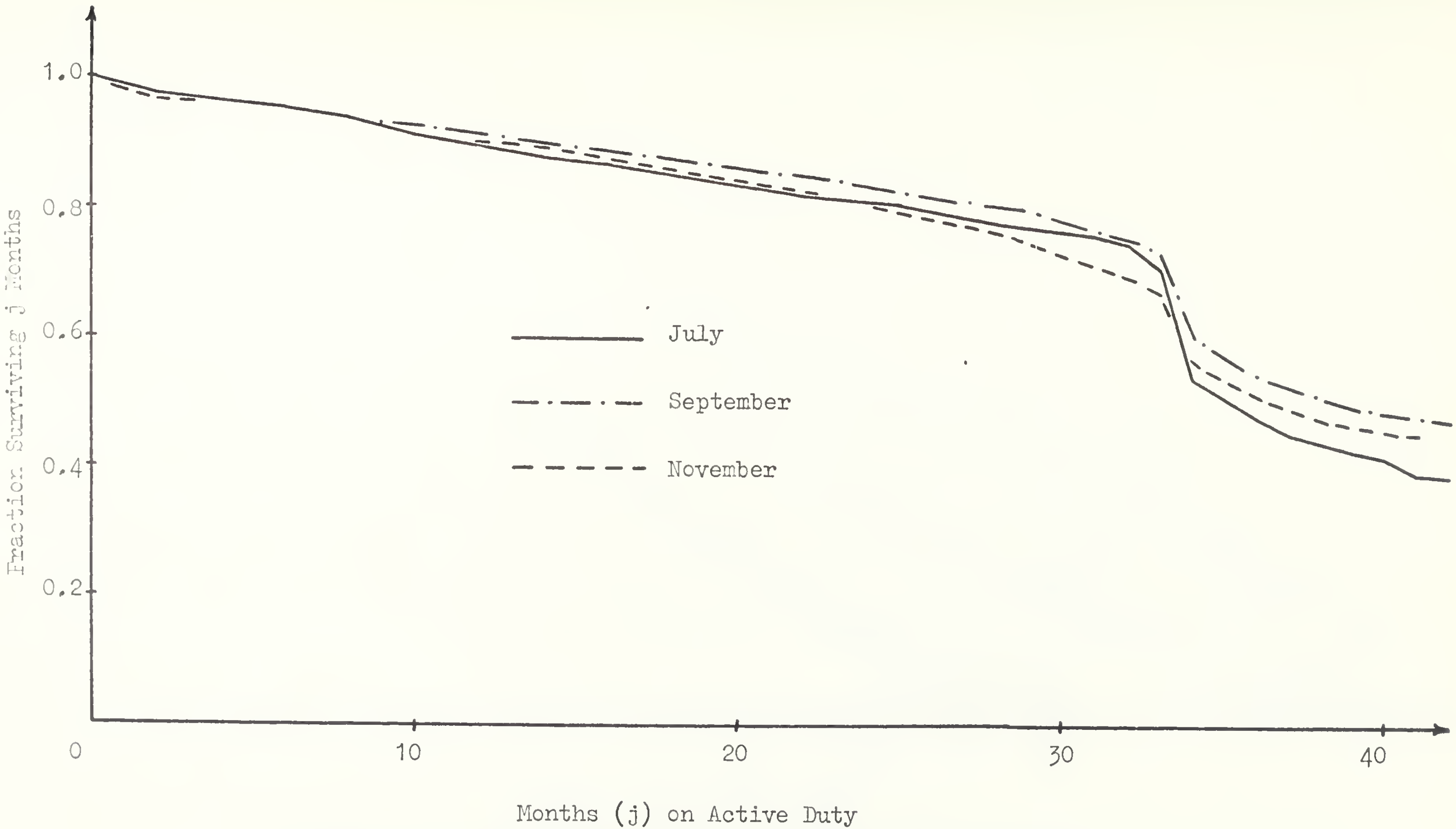


Figure 5: Distributions for Four-year Total Data Cohorts, July, September, November 1967

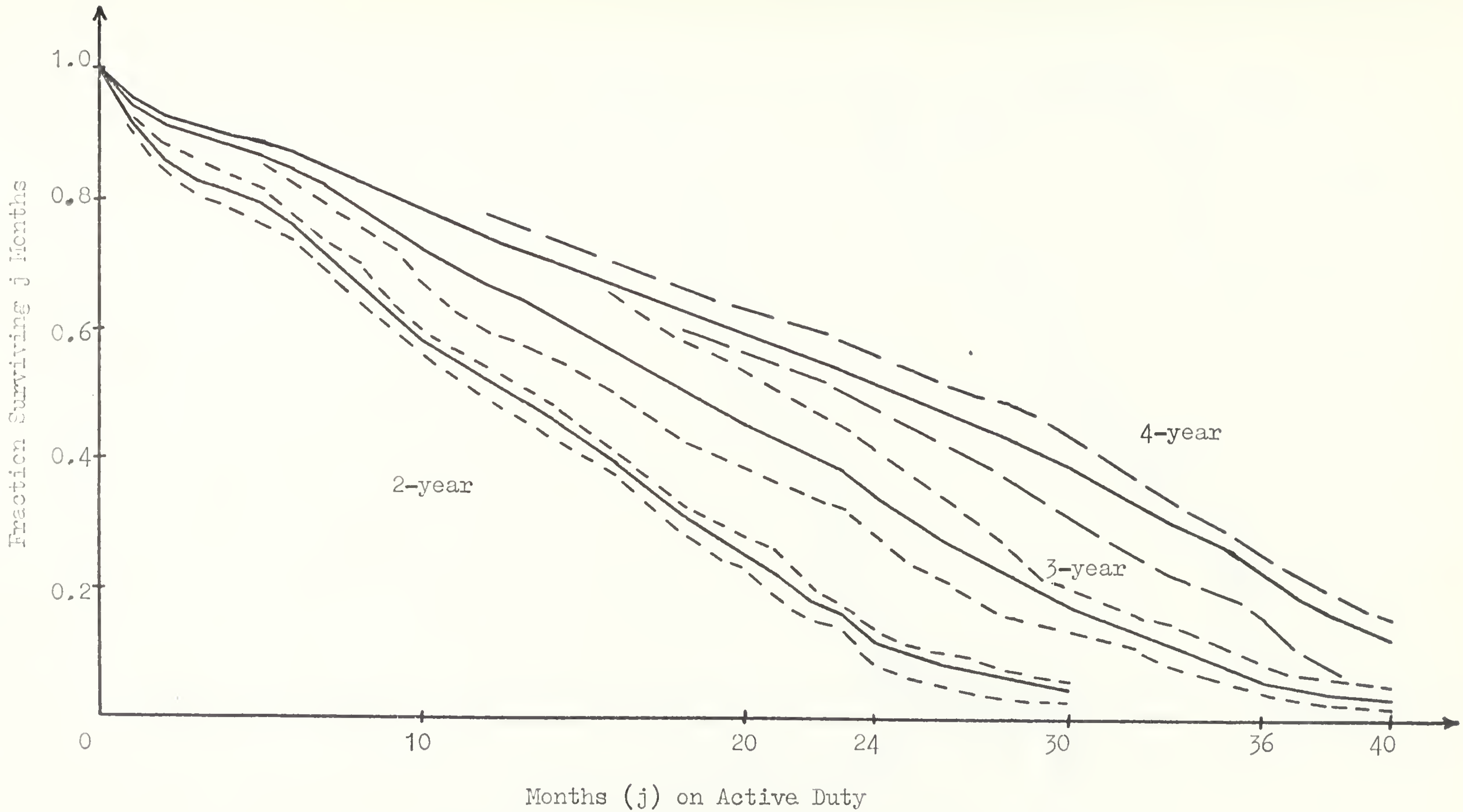


Figure 6: Aggregate Attrition Distributions with Envelopes

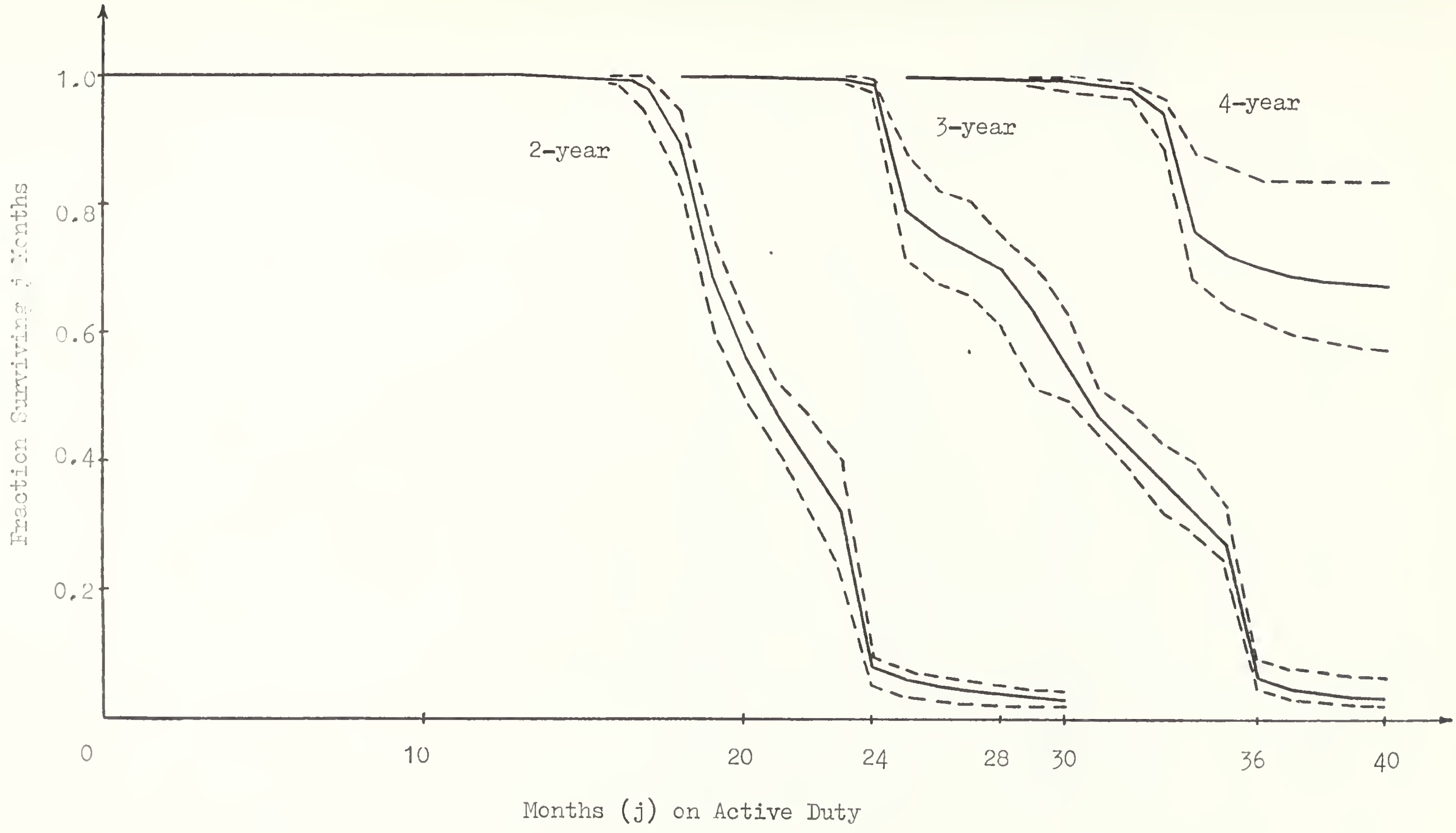


Figure 7: Aggregate EOAS Distributions with Envelopes

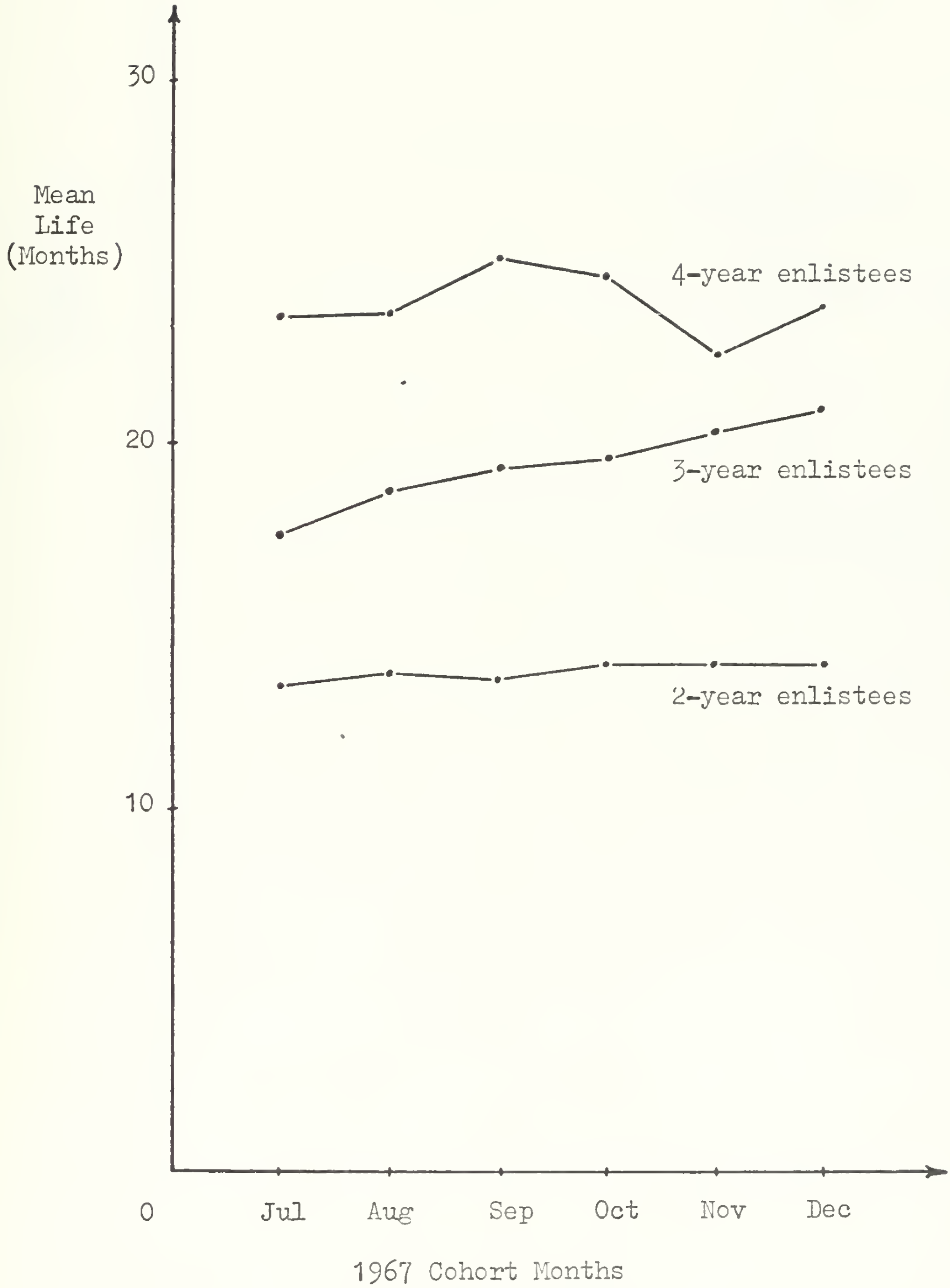


Figure 8: Attrition Mean Lifetimes

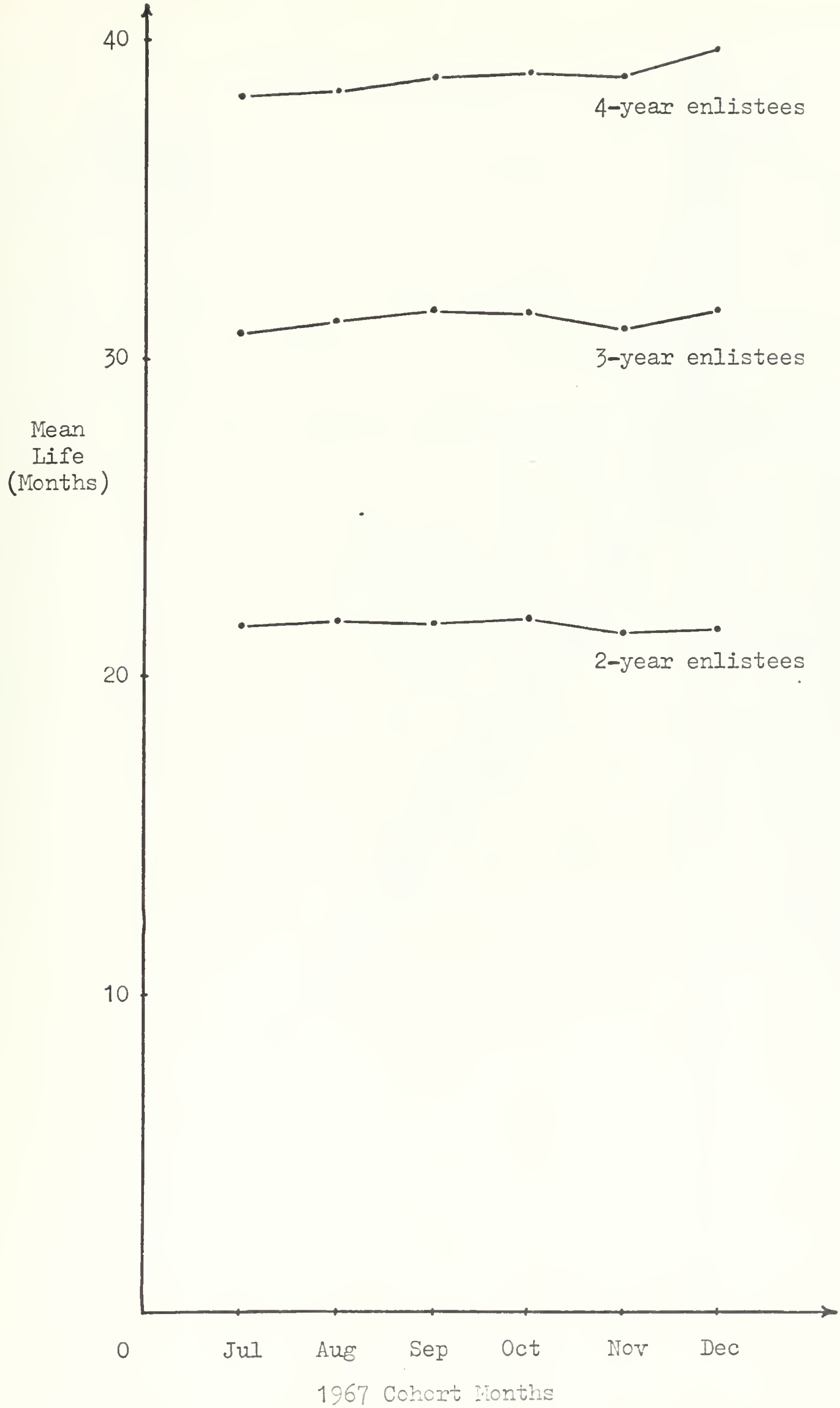


Figure 9: EOAS Mean Lifetimes

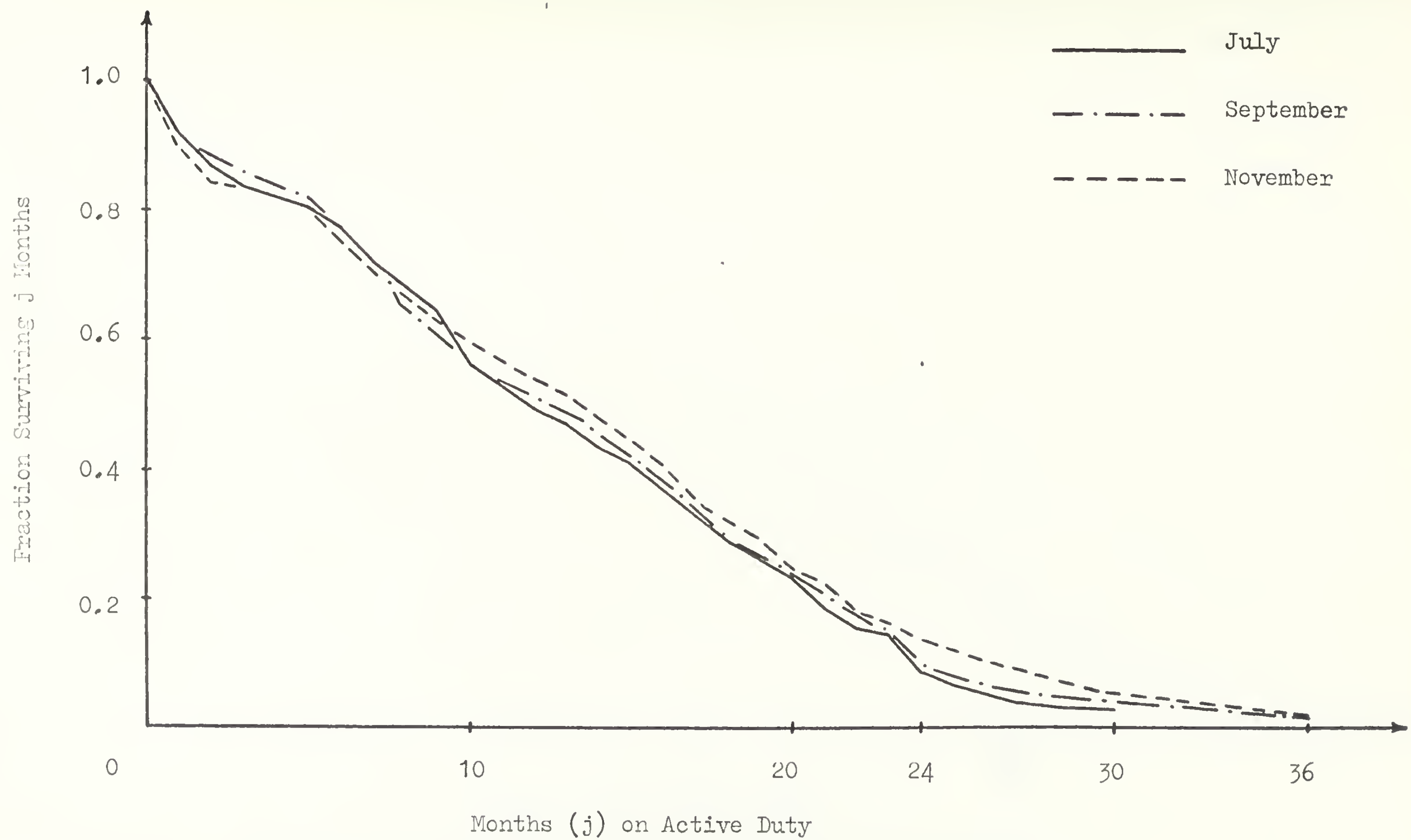


Figure 10: Distributions for Two-year Attrition Cohorts
July, September, November 1967

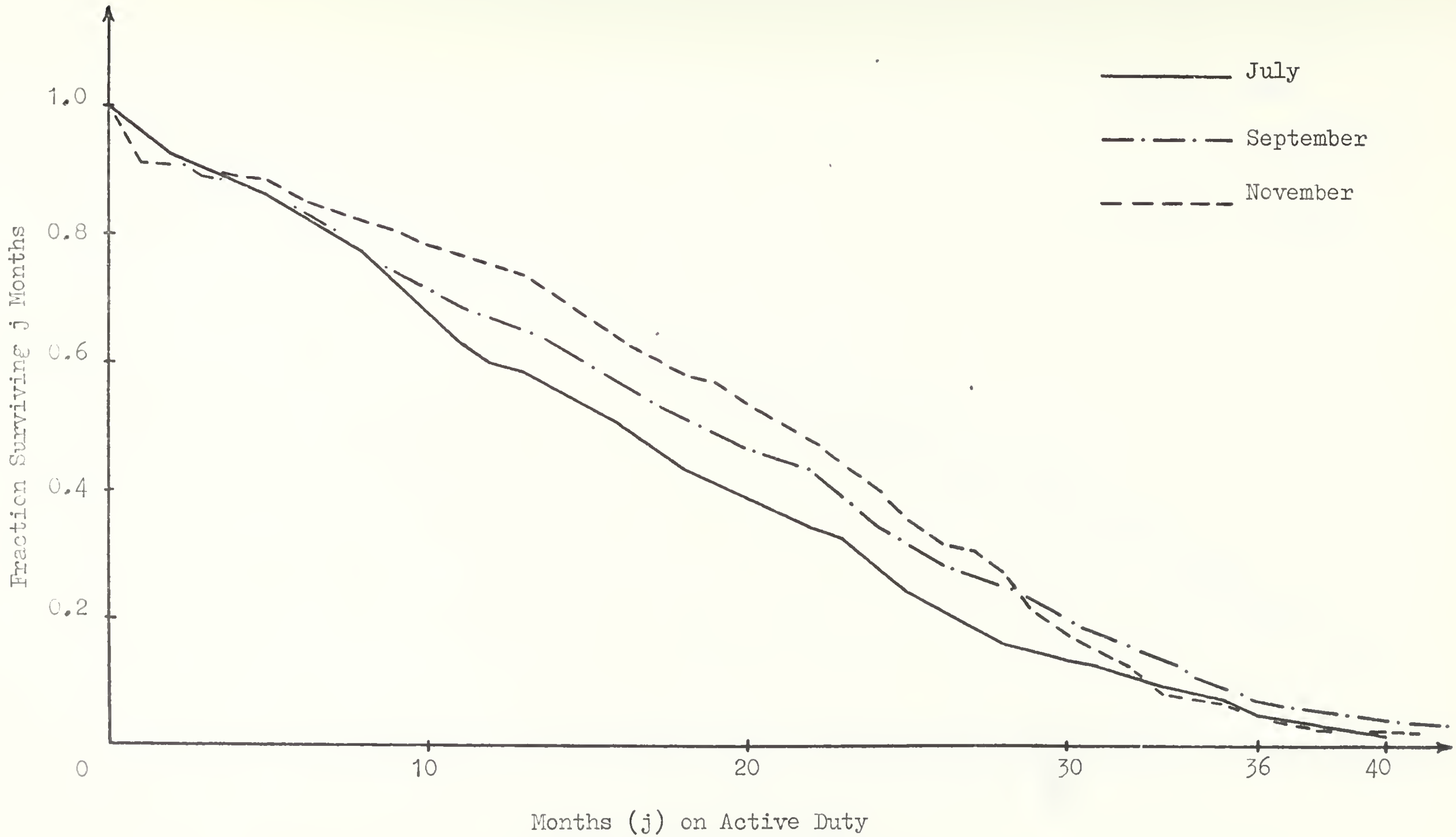


Figure 11: Distributions for Three-year Attrition Cohorts
July, September, November 1967

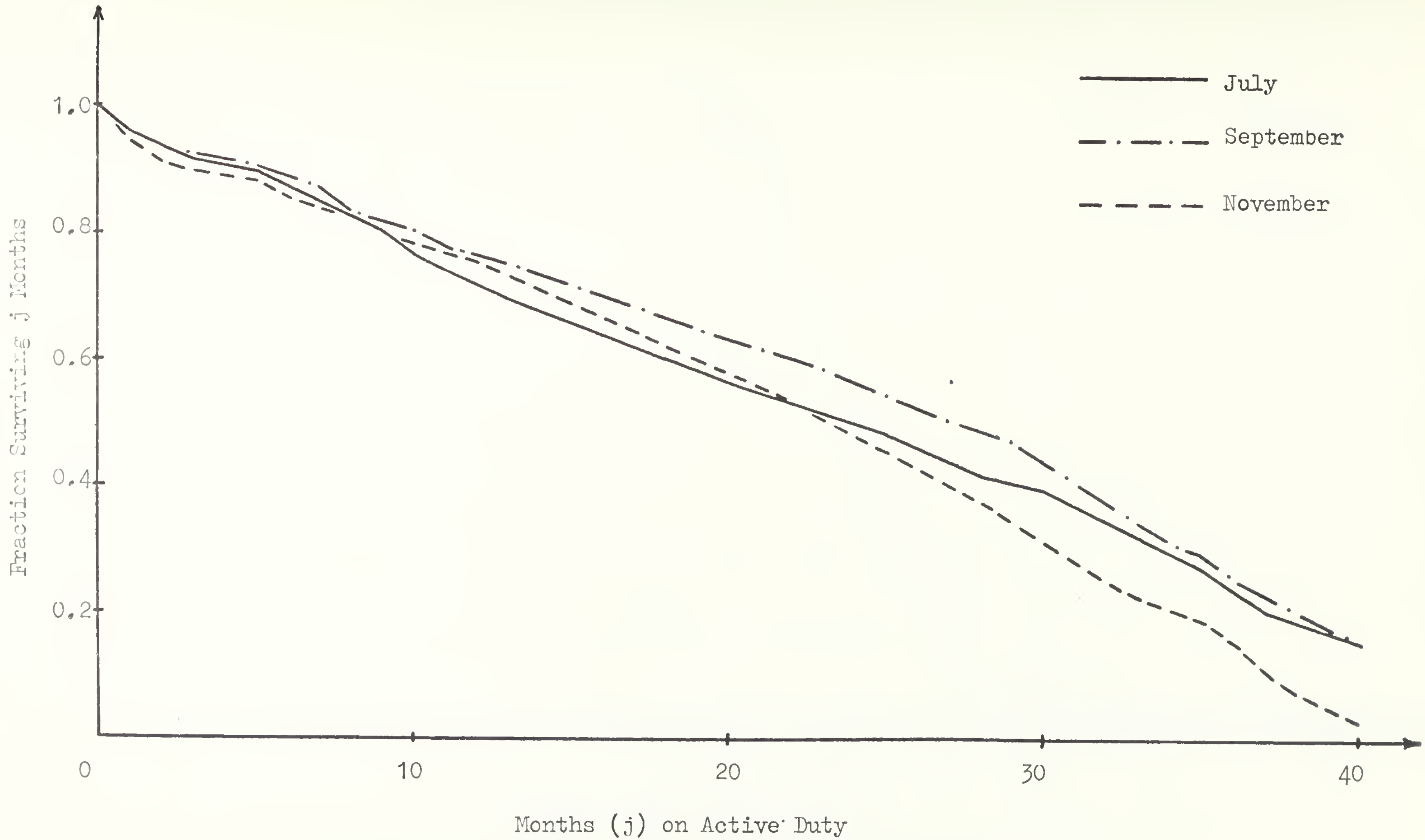


Figure 12: Distributions for Four-year Attrition Cohorts
July, September, November 1967

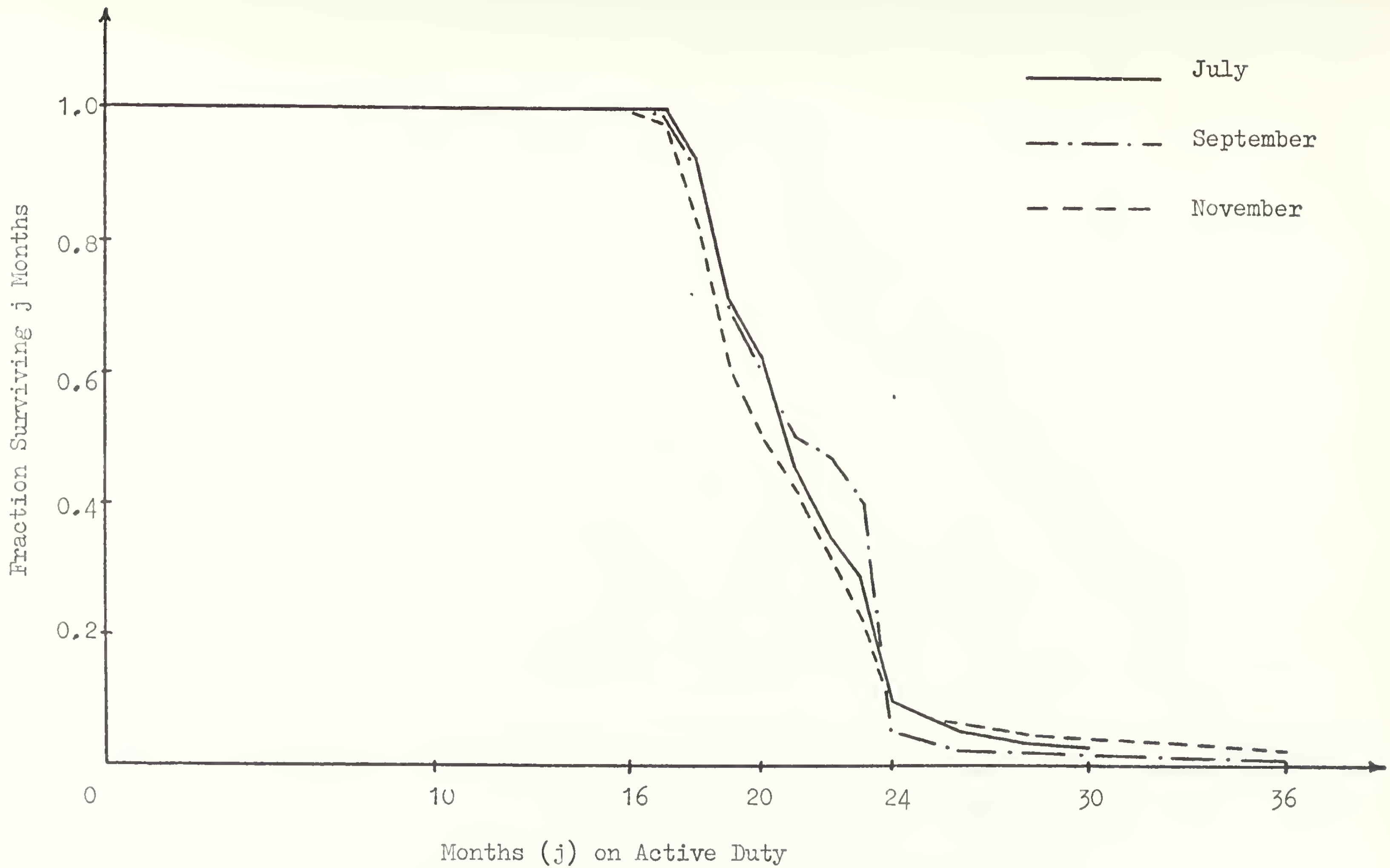


Figure 13: Distributions for Two-year EOAS Cohorts
July, September, November 1967

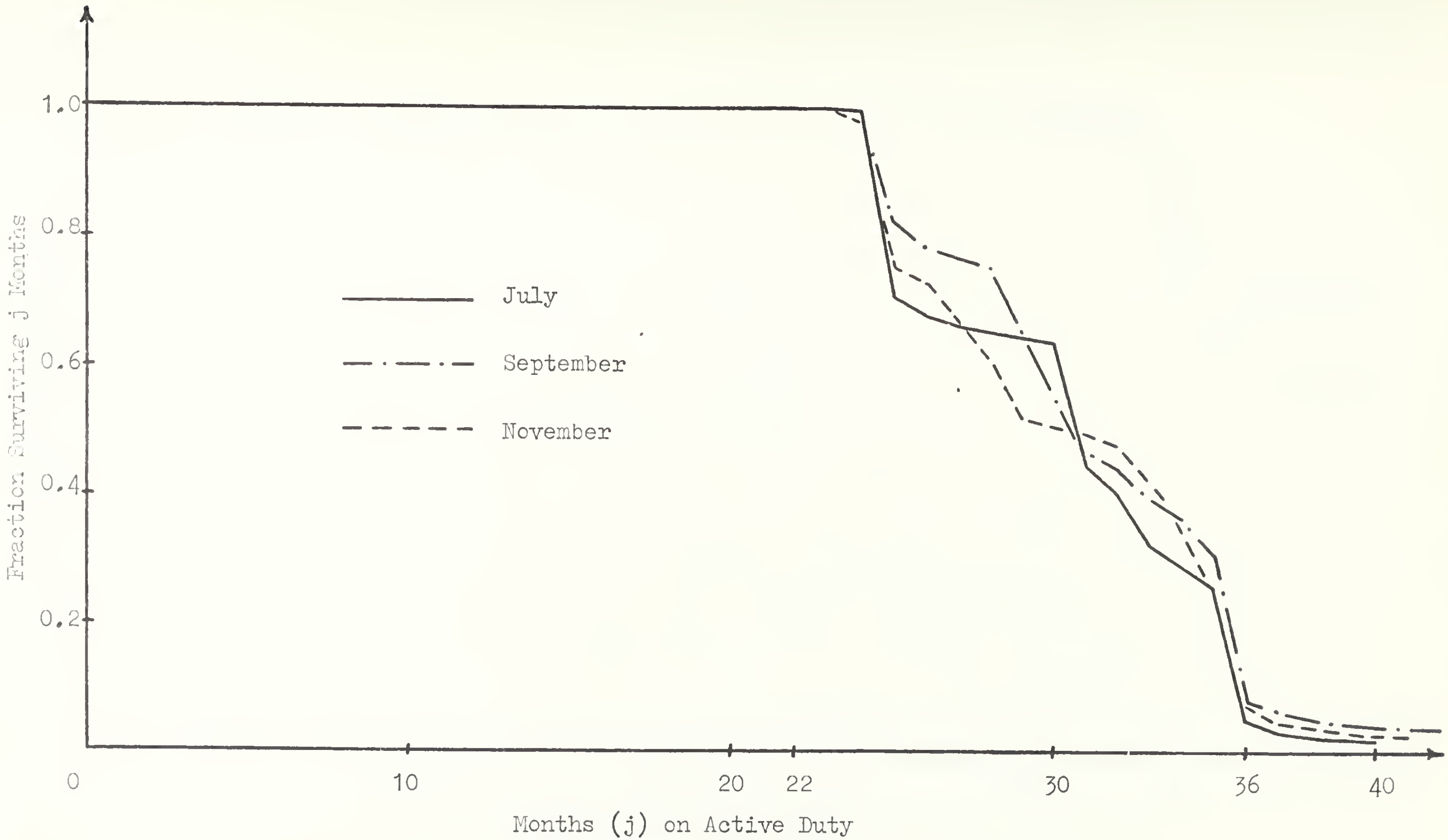


Figure 14: Distributions for Three-year EOAS Cohorts
July, September, November 1967

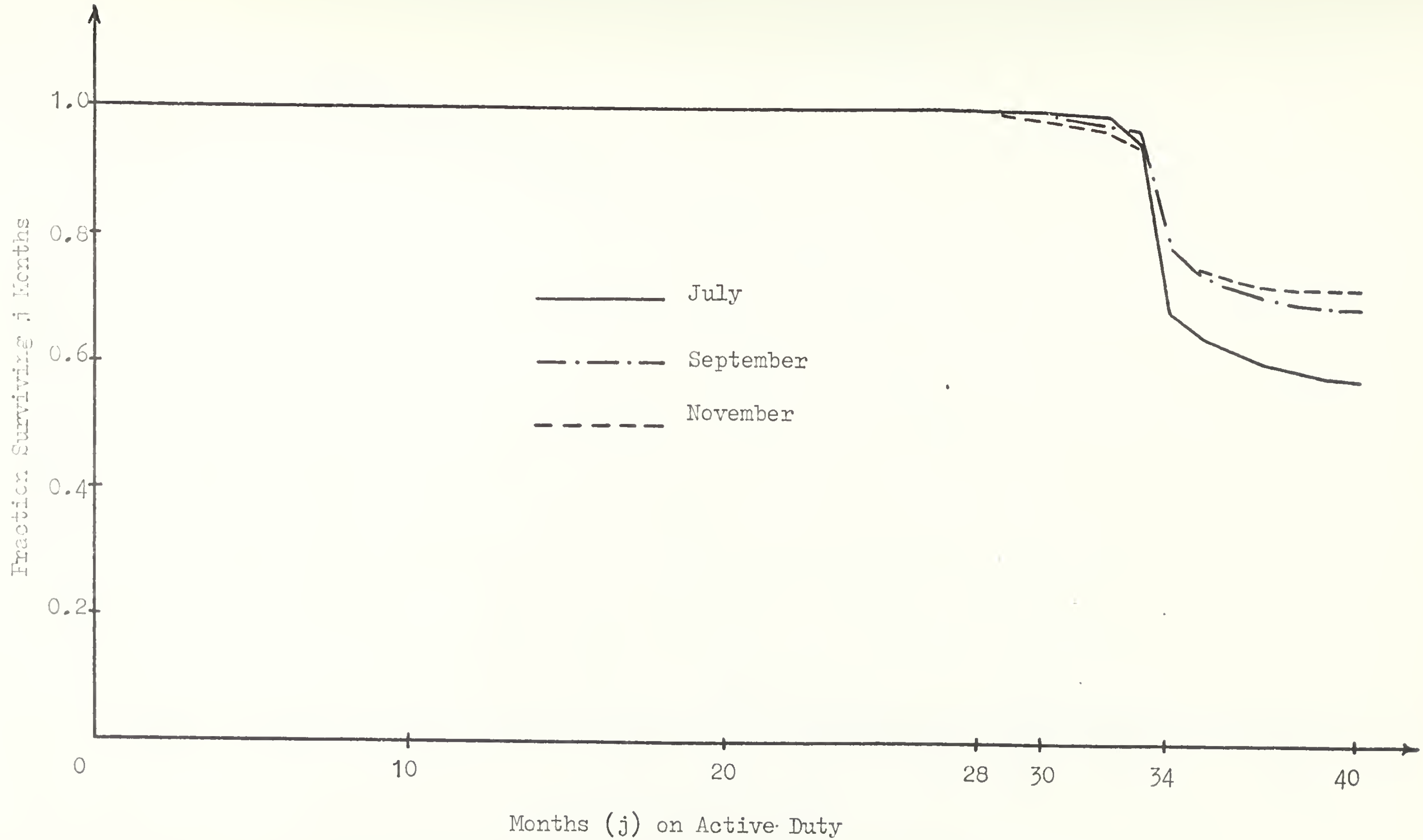


Figure 15: Distributions for Four-year EOAS Cohorts July, September, November 1967

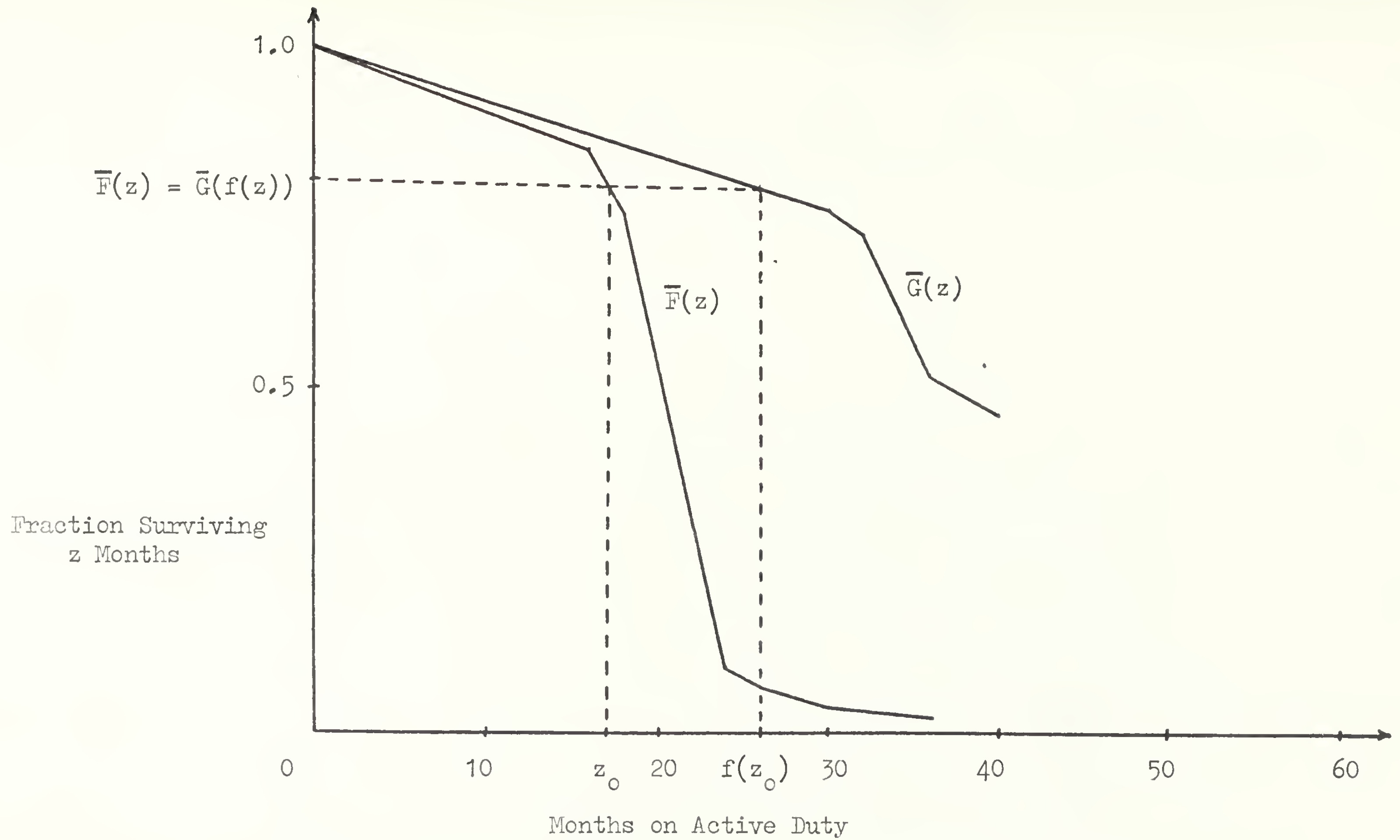


Figure 16: Relationship Between Distributions

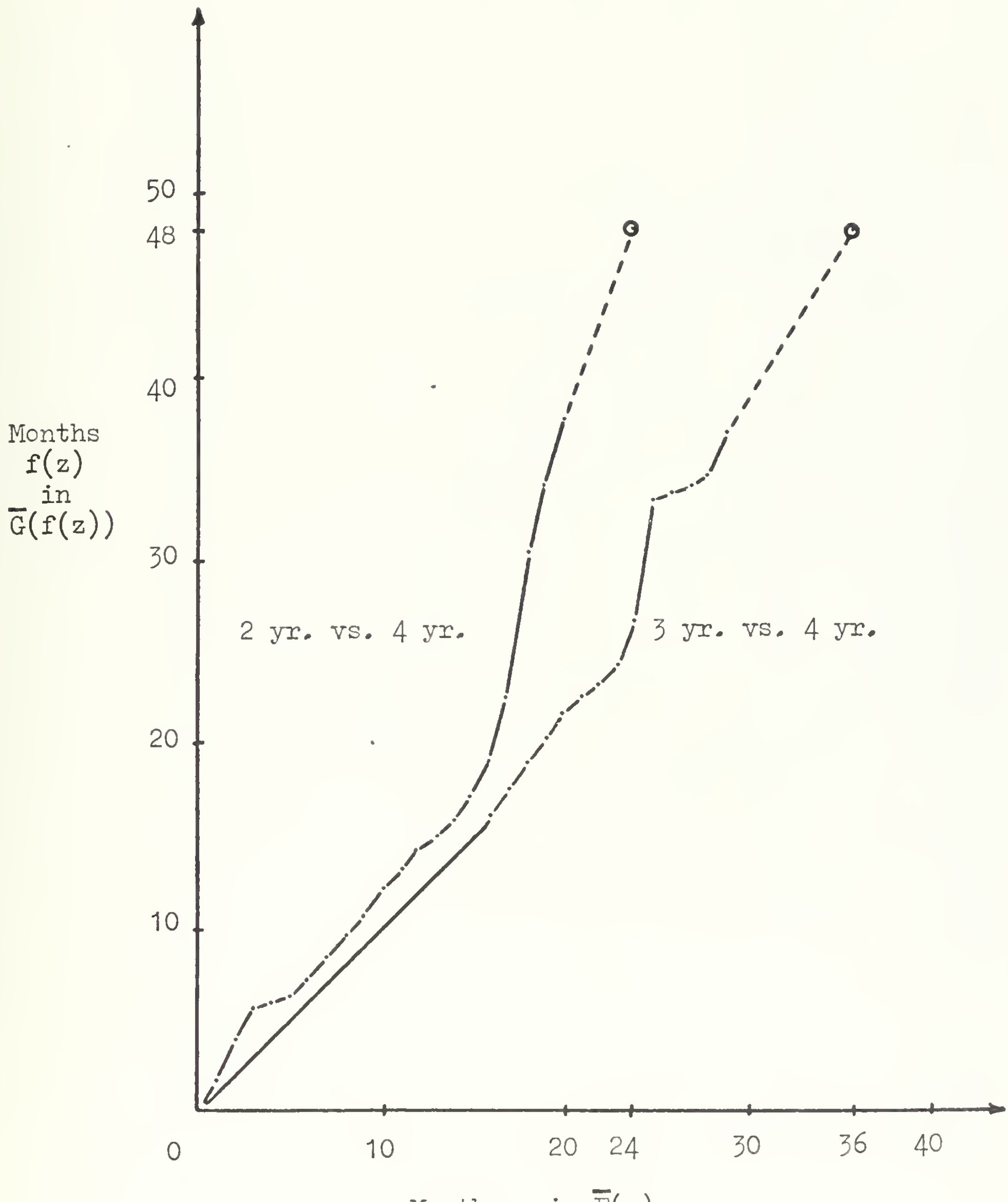


Figure 17: Functional Relationships

2 yr. vs. 4 year and 3 yr. vs. 4 yr.

Total Data Aggregate Distributions

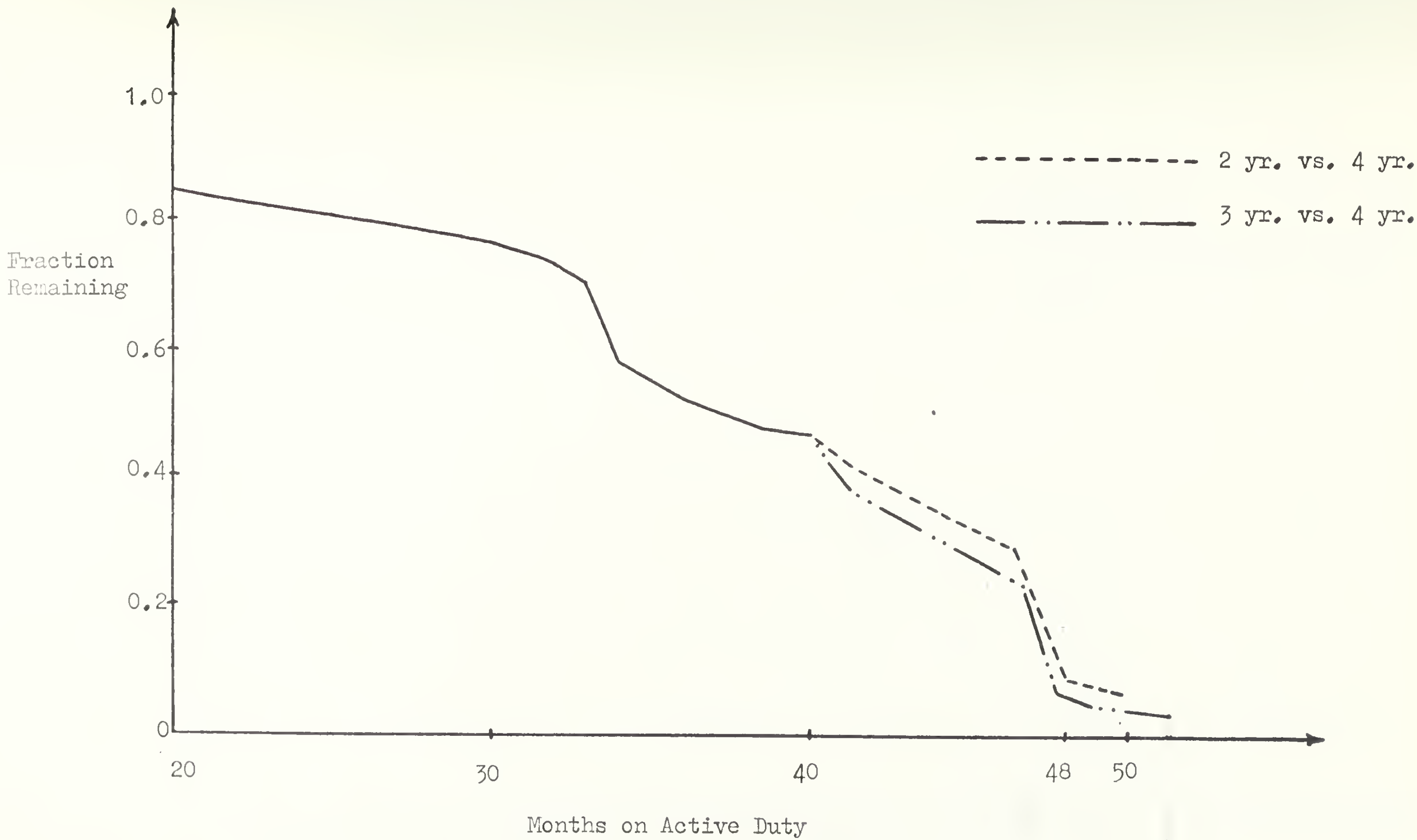


Figure 18: Aggregate Total Data Second-degree Polynomial Extrapolations

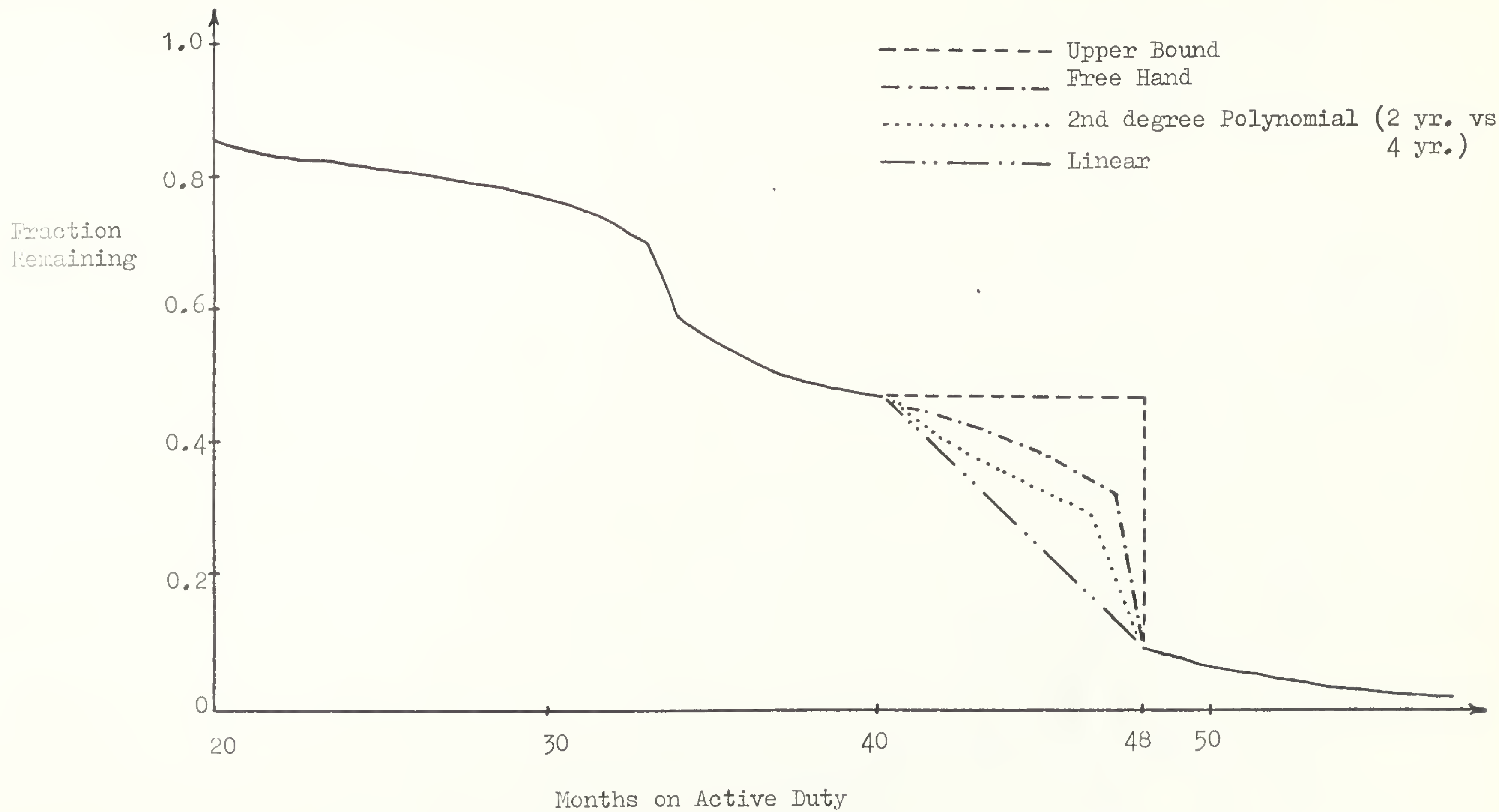


Figure 19: Aggregate Four-year Total Data Sensitivity Extrapolations

## APPENDIX A

## THE DATA BASE

The following data in the format described in Chapter II (Table I) provide the basis for the distributions plotted in this thesis. These data include two-year cohorts from July 1967 through June 1968 and three-year and four-year cohorts from July 1967 through December 1967. Also used as inputs to the model are the initial cohort strengths for all cohorts from January 1967 through December 1971. These values are listed.

Two - year Cohort Starting in July 1967

Initial Strength = 1725

| Month after start | Losses by Groups R1 | R2 | R3 | R4 | R5 | Row Total | Number Remaining |
|---|---|---|---|---|---|---|---|
| 1 | 36 | 0 | 0 | 0 | 0 | 36 | 1689 |
| 2 | 20 | 0 | 0 | 0 | 0 | 20 | 1669 |
| 3 | 13 | 0 | 0 | 0 | 0 | 13 | 1656 |
| 4 | 7 | 0 | 0 | 0 | 0 | 7 | 1649 |
| 5 | 8 | 0 | 1 | 0 | 0 | 9 | 1640 |
| 6 | 11 | 0 | 0 | 0 | 0 | 11 | 1629 |
| 7 | 25 | 0 | 0 | 1 | 0 | 26 | 1603 |
| 8 | 11 | 0 | 0 | 0 | 5 | 16 | 1587 |
| 9 | 12 | 0 | 0 | 0 | 2 | 14 | 1573 |
| 10 | 32 | 0 | 0 | 1 | 2 | 35 | 1538 |
| 11 | 13 | 0 | 0 | 0 | 0 | 13 | 1525 |
| 12 | 15 | 0 | 0 | 1 | 0 | 16 | 1509 |
| 13 | 9 | 0 | 1 | 0 | 0 | 10 | 1499 |
| 14 | 16 | 0 | 0 | 0 | 0 | 16 | 1483 |
| 15 | 10 | 0 | 0 | 0 | 0 | 10 | 1473 |
| 16 | 12 | 2 | 1 | 1 | 0 | 16 | 1457 |
| 17 | 17 | 2 | 3 | 1 | 0 | 23 | 1434 |
| 18 | 13 | 2 | 106 | 1 | 0 | 122 | 1312 |
| 19 | 13 | 0 | 279 | 1 | 0 | 293 | 1019 |
| 20 | 8 | 2 | 101 | 0 | 0 | 111 | 908 |
| 21 | 14 | 6 | 224 | 1 | 0 | 245 | 663 |
| 22 | 12 | 1 | 123 | 0 | 0 | 136 | 527 |
| 23 | 4 | 0 | 86 | 0 | 0 | 90 | 437 |
| 24 | 17 | 7 | 250 | 0 | 0 | 274 | 163 |
| 25 | 7 | 1 | 28 | 0 | 0 | 36 | 127 |
| 26 | 5 | 0 | 29 | 0 | 0 | 34 | 93 |
| 27 | 5 | 1 | 14 | 1 | 0 | 21 | 72 |
| 28 | 2 | 0 | 7 | 0 | 0 | 9 | 63 |
| 29 | 2 | 0 | 3 | 1 | 0 | 6 | 57 |
| 30 | 0 | 0 | 5 | 0 | 0 | 5 | 52 |
| Total Losses | 369 | 24 | 1261 | 10 | 9 | 1673 | |

Two - year Cohort Starting in August 1967

Initial Strength = 1822

| Month after start | Losses by Groups R1 | R2 | R3 | R4 | R5 | Row Total | Number Remaining |
|---|---|---|---|---|---|---|---|
| 1 | 35 | 0 | 0 | 0 | 0 | 35 | 1787 |
| 2 | 19 | 0 | 0 | 0 | 0 | 19 | 1768 |
| 3 | 10 | 0 | 0 | 0 | 0 | 10 | 1758 |
| 4 | 8 | 0 | 0 | 0 | 0 | 8 | 1750 |
| 5 | 5 | 0 | 0 | 1 | 0 | 6 | 1744 |
| 6 | 9 | 0 | 0 | 0 | 0 | 9 | 1735 |
| 7 | 12 | 0 | 0 | 0 | 1 | 13 | 1722 |
| 8 | 8 | 0 | 0 | 0 | 2 | 10 | 1712 |
| 9 | 30 | 0 | 0 | 1 | 8 | 39 | 1673 |
| 10 | 9 | 0 | 2 | 0 | 0 | 11 | 1662 |
| 11 | 18 | 0 | 1 | 0 | 0 | 19 | 1643 |
| 12 | 9 | 0 | 0 | 0 | 1 | 10 | 1633 |
| 13 | 14 | 0 | 0 | 0 | 0 | 14 | 1619 |
| 14 | 5 | 1 | 0 | 0 | 0 | 6 | 1613 |
| 15 | 12 | 2 | 0 | 0 | 0 | 14 | 1599 |
| 16 | 6 | 1 | 1 | 0 | 0 | 8 | 1591 |
| 17 | 17 | 0 | 9 | 0 | 0 | 26 | 1565 |
| 18 | 11 | 0 | 90 | 0 | 0 | 101 | 1464 |
| 19 | 15 | 2 | 260 | 0 | 0 | 277 | 1187 |
| 20 | 7 | 0 | 241 | 0 | 0 | 248 | 939 |
| 21 | 9 | 3 | 80 | 1 | 0 | 93 | 846 |
| 22 | 7 | 1 | 199 | 2 | 0 | 209 | 637 |
| 23 | 12 | 2 | 64 | 0 | 0 | 78 | 559 |
| 24 | 14 | 3 | 387 | 1 | 0 | 405 | 154 |
| 25 | 4 | 1 | 41 | 0 | 0 | 46 | 108 |
| 26 | 2 | 0 | 16 | 0 | 0 | 18 | 90 |
| 27 | 4 | 0 | 10 | 0 | 0 | 14 | 76 |
| 28 | 5 | 0 | 6 | 0 | 0 | 11 | 65 |
| 29 | 2 | 0 | 2 | 0 | 0 | 4 | 61 |
| 30 | 0 | 0 | 3 | 0 | 0 | 3 | 58 |
| 31 | 3 | 0 | 2 | 0 | 0 | 5 | 53 |
| 32 | 2 | 1 | 1 | 0 | 0 | 4 | 49 |
| 33 | 3 | 0 | 2 | 0 | 0 | 5 | 44 |
| 34 | 4 | 0 | 2 | 0 | 0 | 6 | 38 |
| 35 | 4 | 0 | 0 | 0 | 0 | 4 | 34 |
| 36 | 0 | 0 | 2 | 0 | 0 | 2 | 32 |
| Total Losses | 334 | 17 | 1421 | 6 | 12 | 1790 | |

Two - year Cohort Starting in September 1967

Initial Strength = 1848

| Month after start | Losses by Groups R1 | R2 | R3 | R4 | R5 | Row Total | Number Remaining |
|---|---|---|---|---|---|---|---|
| 1 | 32 | 0 | 0 | 0 | 0 | 32 | 1816 |
| 2 | 10 | 0 | 0 | 0 | 0 | 10 | 1806 |
| 3 | 7 | 0 | 0 | 0 | 0 | 7 | 1799 |
| 4 | 8 | 0 | 0 | 0 | 0 | 8 | 1791 |
| 5 | 5 | 0 | 0 | 1 | 0 | 6 | 1785 |
| 6 | 15 | 0 | 0 | 2 | 0 | 17 | 1768 |
| 7 | 11 | 0 | 0 | 0 | 5 | 16 | 1752 |
| 8 | 19 | 0 | 1 | 0 | 10 | 30 | 1722 |
| 9 | 13 | 0 | 0 | 0 | 0 | 13 | 1709 |
| 10 | 15 | 0 | 1 | 0 | 0 | 16 | 1693 |
| 11 | 9 | 0 | 0 | 0 | 3 | 12 | 1681 |
| 12 | 6 | 0 | 0 | 1 | 0 | 7 | 1674 |
| 13 | 8 | 0 | 0 | 0 | 1 | 9 | 1665 |
| 14 | 13 | 0 | 0 | 0 | 0 | 13 | 1652 |
| 15 | 9 | 1 | 0 | 0 | 0 | 10 | 1642 |
| 16 | 15 | 0 | 5 | 0 | 0 | 20 | 1622 |
| 17 | 13 | 1 | 13 | 0 | 0 | 27 | 1595 |
| 18 | 16 | 1 | 117 | 0 | 0 | 134 | 1461 |
| 19 | 7 | 2 | 328 | 0 | 0 | 337 | 1124 |
| 20 | 9 | 1 | 149 | 0 | 0 | 159 | 965 |
| 21 | 8 | 3 | 128 | 0 | 0 | 139 | 826 |
| 22 | 8 | 3 | 43 | 0 | 0 | 54 | 772 |
| 23 | 7 | 2 | 102 | 0 | 0 | 111 | 661 |
| 24 | 13 | 6 | 529 | 0 | 0 | 548 | 113 |
| 25 | 7 | 0 | 25 | 0 | 0 | 32 | 81 |
| 26 | 4 | 0 | 16 | 0 | 0 | 20 | 61 |
| 27 | 4 | 0 | 3 | 0 | 0 | 7 | 54 |
| 28 | 2 | 0 | 1 | 0 | 0 | 3 | 51 |
| 29 | 1 | 0 | 4 | 0 | 0 | 5 | 46 |
| 30 | 2 | 0 | 3 | 0 | 0 | 5 | 41 |
| 31 | 0 | 0 | 1 | 0 | 0 | 1 | 40 |
| 32 | 1 | 0 | 1 | 0 | 0 | 2 | 38 |
| 33 | 2 | 0 | 0 | 0 | 0 | 2 | 36 |
| 34 | 2 | 0 | 2 | 0 | 0 | 4 | 32 |
| 35 | 1 | 0 | 1 | 0 | 0 | 2 | 30 |
| 36 | 2 | 0 | 4 | 0 | 0 | 6 | 24 |
| Total Losses | 304 | 20 | 1477 | 4 | 19 | 1824 | |

Two - year Cohort Starting in October 1967

Initial Strength = 2034

| Month after start | Losses by Groups R1 | R2 | R3 | R4 | R5 | Row Total | Number Remaining |
|---|---|---|---|---|---|---|---|
| 1 | 38 | 0 | 0 | 0 | 0 | 38 | 1996 |
| 2 | 35 | 0 | 0 | 1 | 0 | 36 | 1960 |
| 3 | 15 | 0 | 0 | 0 | 0 | 15 | 1945 |
| 4 | 10 | 0 | 0 | 0 | 0 | 10 | 1935 |
| 5 | 5 | 0 | 0 | 0 | 0 | 5 | 1930 |
| 6 | 10 | 0 | 0 | 1 | 0 | 11 | 1919 |
| 7 | 32 | 0 | 0 | 0 | 3 | 35 | 1884 |
| 8 | 20 | 0 | 0 | 0 | 0 | 20 | 1864 |
| 9 | 10 | 0 | 0 | 0 | 0 | 10 | 1854 |
| 10 | 22 | 0 | 0 | 0 | 8 | 30 | 1824 |
| 11 | 10 | 0 | 0 | 0 | 0 | 10 | 1814 |
| 12 | 13 | 0 | 0 | 1 | 1 | 15 | 1799 |
| 13 | 10 | 1 | 0 | 0 | 0 | 11 | 1788 |
| 14 | 10 | 1 | 0 | 1 | 0 | 12 | 1776 |
| 15 | 14 | 0 | 0 | 1 | 0 | 15 | 1761 |
| 16 | 12 | 1 | 5 | 1 | 1 | 20 | 1741 |
| 17 | 19 | 2 | 10 | 0 | 0 | 31 | 1710 |
| 18 | 14 | 2 | 73 | 1 | 1 | 91 | 1619 |
| 19 | 18 | 0 | 376 | 0 | 0 | 394 | 1225 |
| 20 | 5 | 1 | 205 | 0 | 0 | 211 | 1014 |
| 21 | 9 | 2 | 72 | 1 | 0 | 84 | 930 |
| 22 | 17 | 6 | 110 | 2 | 0 | 135 | 795 |
| 23 | 16 | 1 | 137 | 0 | 0 | 154 | 641 |
| 24 | 17 | 5 | 432 | 0 | 0 | 454 | 187 |
| 25 | 13 | 0 | 33 | 0 | 0 | 46 | 141 |
| 26 | 7 | 0 | 17 | 0 | 0 | 24 | 117 |
| 27 | 3 | 0 | 18 | 1 | 0 | 22 | 95 |
| 28 | 3 | 0 | 3 | 1 | 0 | 7 | 88 |
| 29 | 5 | 0 | 6 | 0 | 0 | 11 | 77 |
| 30 | 7 | 0 | 2 | 0 | 0 | 9 | 68 |
| 31 | 2 | 0 | 0 | 0 | 0 | 2 | 66 |
| 32 | 6 | 0 | 2 | 0 | 0 | 8 | 58 |
| 33 | 3 | 0 | 2 | 0 | 0 | 5 | 53 |
| 34 | 2 | 0 | 1 | 0 | 0 | 3 | 50 |
| 35 | 1 | 0 | 4 | 0 | 0 | 5 | 45 |
| 36 | 0 | 1 | 5 | 0 | 0 | 6 | 39 |
| Total Losses | 433 | 23 | 1513 | 12 | 14 | 1995 | |

Two - year Cohort Starting in November 1967

Initial Strength = 2174

| Month after start | Losses by Groups R1 | R2 | R3 | R4 | R5 | Row Total | Number Remaining |
|---|---|---|---|---|---|---|---|
| 1 | 58 | 0 | 0 | 0 | 0 | 58 | 2116 |
| 2 | 32 | 0 | 0 | 0 | 0 | 32 | 2084 |
| 3 | 6 | 0 | 0 | 0 | 0 | 6 | 2078 |
| 4 | 7 | 0 | 0 | 1 | 0 | 8 | 2070 |
| 5 | 6 | 0 | 0 | 0 | 0 | 6 | 2064 |
| 6 | 27 | 0 | 0 | 1 | 1 | 29 | 2035 |
| 7 | 30 | 0 | 1 | 0 | 0 | 31 | 2004 |
| 8 | 20 | 0 | 0 | 0 | 0 | 20 | 1984 |
| 9 | 19 | 0 | 0 | 0 | 5 | 24 | 1960 |
| 10 | 17 | 0 | 0 | 0 | 0 | 17 | 1943 |
| 11 | 14 | 0 | 0 | 0 | 4 | 18 | 1925 |
| 12 | 13 | 0 | 0 | 0 | 0 | 13 | 1912 |
| 13 | 13 | 0 | 0 | 1 | 1 | 15 | 1897 |
| 14 | 19 | 0 | 1 | 0 | 0 | 20 | 1877 |
| 15 | 19 | 0 | 10 | 2 | 0 | 31 | 1846 |
| 16 | 28 | 0 | 4 | 0 | 0 | 32 | 1814 |
| 17 | 24 | 3 | 24 | 2 | 0 | 53 | 1761 |
| 18 | 17 | 0 | 234 | 1 | 0 | 252 | 1509 |
| 19 | 14 | 1 | 361 | 0 | 0 | 376 | 1133 |
| 20 | 24 | 2 | 167 | 0 | 0 | 193 | 940 |
| 21 | 11 | 1 | 122 | 0 | 0 | 134 | 806 |
| 22 | 21 | 4 | 159 | 1 | 0 | 135 | 621 |
| 23 | 8 | 0 | 147 | 0 | 0 | 155 | 466 |
| 24 | 11 | 6 | 230 | 1 | 0 | 248 | 218 |
| 25 | 7 | 1 | 25 | 0 | 0 | 33 | 185 |
| 26 | 5 | 0 | 11 | 1 | 0 | 17 | 168 |
| 27 | 9 | 0 | 15 | 0 | 0 | 24 | 144 |
| 28 | 8 | 0 | 8 | 0 | 0 | 16 | 128 |
| 29 | 3 | 3 | 14 | 0 | 0 | 20 | 108 |
| 30 | 6 | 0 | 3 | 0 | 0 | 9 | 99 |
| 31 | 3 | 0 | 2 | 0 | 0 | 5 | 94 |
| 32 | 3 | 0 | 2 | 0 | 0 | 5 | 89 |
| 33 | 7 | 0 | 5 | 0 | 0 | 12 | 77 |
| 34 | 2 | 1 | 7 | 2 | 0 | 12 | 65 |
| 35 | 1 | 0 | 4 | 1 | 0 | 6 | 59 |
| 36 | 2 | 0 | 9 | 0 | 0 | 11 | 48 |
| Total Losses | 514 | 22 | 1565 | 14 | 11 | 2126 | |

Two - year Cohort Starting in December 1967

Initial Strength = 2367

| Month after start | Losses by Groups R1 | R2 | R3 | R4 | R5 | Row Total | Number Remaining |
|---|---|---|---|---|---|---|---|
| 1 | 43 | 0 | 0 | 0 | 0 | 43 | 2324 |
| 2 | 48 | 0 | 0 | 0 | 0 | 48 | 2276 |
| 3 | 22 | 0 | 0 | 0 | 0 | 22 | 2254 |
| 4 | 11 | 0 | 0 | 0 | 0 | 11 | 2243 |
| 5 | 13 | 0 | 0 | 0 | 0 | 13 | 2230 |
| 6 | 14 | 0 | 0 | 1 | 0 | 15 | 2215 |
| 7 | 12 | 0 | 0 | 1 | 0 | 13 | 2202 |
| 8 | 14 | 0 | 0 | 2 | 11 | 27 | 2175 |
| 9 | 24 | 0 | 0 | 2 | 0 | 26 | 2149 |
| 10 | 15 | 0 | 0 | 1 | 3 | 19 | 2130 |
| 11 | 15 | 0 | 0 | 0 | 1 | 16 | 2114 |
| 12 | 14 | 0 | 0 | 0 | 0 | 14 | 2100 |
| 13 | 16 | 1 | 1 | 0 | 0 | 18 | 2082 |
| 14 | 24 | 1 | 7 | 0 | 0 | 32 | 2050 |
| 15 | 26 | 0 | 4 | 0 | 0 | 30 | 2020 |
| 16 | 11 | 0 | 13 | 0 | 0 | 24 | 1996 |
| 17 | 25 | 1 | 87 | 2 | 0 | 115 | 1881 |
| 18 | 15 | 1 | 128 | 1 | 0 | 145 | 1736 |
| 19 | 13 | 4 | 325 | 0 | 0 | 342 | 1394 |
| 20 | 18 | 1 | 246 | 3 | 0 | 268 | 1126 |
| 21 | 16 | 3 | 205 | 0 | 0 | 224 | 902 |
| 22 | 16 | 5 | 92 | 1 | 0 | 114 | 788 |
| 23 | 10 | 0 | 105 | 3 | 0 | 118 | 670 |
| 24 | 15 | 6 | 398 | 1 | 0 | 420 | 250 |
| 25 | 11 | 0 | 30 | 0 | 0 | 41 | 209 |
| 26 | 6 | 0 | 18 | 2 | 0 | 26 | 183 |
| 27 | 12 | 0 | 14 | 0 | 0 | 26 | 157 |
| 28 | 2 | 1 | 13 | 1 | 0 | 17 | 140 |
| 29 | 8 | 0 | 9 | 1 | 0 | 18 | 122 |
| 30 | 5 | 0 | 7 | 0 | 0 | 12 | 110 |
| 31 | 6 | 0 | 2 | 1 | 0 | 9 | 101 |
| 32 | 2 | 0 | 7 | 0 | 0 | 9 | 92 |
| 33 | 1 | 0 | 11 | 0 | 0 | 12 | 80 |
| 34 | 5 | 0 | 3 | 0 | 0 | 8 | 72 |
| 35 | 4 | 0 | 7 | 0 | 0 | 11 | 61 |
| 36 | 2 | 0 | 10 | 0 | 0 | 12 | 49 |
| Total Losses | 514 | 24 | 1742 | 23 | 15 | 2318 | |

Two- year Cohort Starting in January 1968

Initial Strength = 4117

| Month after start | Losses by Groups R1 | R2 | R3 | R4 | R5 | Row Total | Number Remaining |
|---|---|---|---|---|---|---|---|
| 1 | 72 | 0 | 0 | 1 | 0 | 73 | 4044 |
| 2 | 57 | 0 | 0 | 1 | 0 | 58 | 3986 |
| 3 | 22 | 0 | 0 | 0 | 0 | 22 | 3964 |
| 4 | 14 | 0 | 0 | 0 | 0 | 14 | 3950 |
| 5 | 15 | 0 | 0 | 0 | 0 | 15 | 3935 |
| 6 | 31 | 0 | 1 | 0 | 0 | 32 | 3903 |
| 7 | 45 | 0 | 0 | 4 | 9 | 58 | 3845 |
| 8 | 33 | 0 | 1 | 1 | 0 | 35 | 3810 |
| 9 | 25 | 0 | 0 | 0 | 14 | 39 | 3771 |
| 10 | 26 | 0 | 0 | 0 | 4 | 30 | 3741 |
| 11 | 26 | 0 | 0 | 0 | 2 | 28 | 3713 |
| 12 | 21 | 1 | 0 | 2 | 0 | 24 | 3689 |
| 13 | 29 | 2 | 5 | 1 | 1 | 38 | 3651 |
| 14 | 46 | 0 | 2 | 1 | 0 | 49 | 3602 |
| 15 | 25 | 3 | 14 | 0 | 0 | 42 | 3560 |
| 16 | 43 | 2 | 107 | 0 | 0 | 152 | 3408 |
| 17 | 26 | 0 | 59 | 0 | 0 | 85 | 3323 |
| 18 | 42 | 5 | 305 | 1 | 0 | 353 | 2970 |
| 19 | 21 | 2 | 653 | 2 | 0 | 678 | 2292 |
| 20 | 30 | 1 | 438 | 2 | 0 | 471 | 1821 |
| 21 | 27 | 2 | 114 | 0 | 0 | 143 | 1678 |
| 22 | 19 | 6 | 98 | 1 | 0 | 124 | 1554 |
| 23 | 16 | 2 | 294 | 2 | 0 | 314 | 1240 |
| 24 | 24 | 11 | 742 | 2 | 0 | 779 | 461 |
| 25 | 21 | 0 | 71 | 3 | 0 | 95 | 366 |
| 26 | 13 | 0 | 28 | 1 | 1 | 43 | 323 |
| 27 | 10 | 0 | 25 | 0 | 0 | 35 | 288 |
| 28 | 18 | 0 | 13 | 0 | 0 | 31 | 257 |
| 29 | 11 | 0 | 7 | 1 | 0 | 19 | 238 |
| 30 | 8 | 0 | 14 | 0 | 0 | 22 | 216 |
| Total Losses | 816 | 37 | 2991 | 26 | 31 | 3901 | |

Two - year Cohort Starting in February 1968

Initial Strength = 3983

| Month after start | Losses by Groups R1 | R2 | R3 | R4 | R5 | Row Total | Number Remaining |
|---|---|---|---|---|---|---|---|
| 1 | 82 | 0 | 0 | 0 | 0 | 82 | 3901 |
| 2 | 50 | 0 | 0 | 0 | 0 | 50 | 3851 |
| 3 | 36 | 0 | 0 | 0 | 0 | 36 | 3815 |
| 4 | 14 | 0 | 0 | 0 | 0 | 14 | 3801 |
| 5 | 14 | 0 | 0 | 1 | 0 | 15 | 3786 |
| 6 | 31 | 0 | 0 | 0 | 1 | 32 | 3754 |
| 7 | 31 | 0 | 0 | 1 | 0 | 32 | 3722 |
| 8 | 25 | 0 | 0 | 3 | 8 | 36 | 3686 |
| 9 | 24 | 0 | 0 | 1 | 11 | 36 | 3650 |
| 10 | 20 | 0 | 0 | 0 | 6 | 26 | 3624 |
| 11 | 36 | 0 | 0 | 0 | 0 | 36 | 3588 |
| 12 | 33 | 0 | 1 | 0 | 4 | 38 | 3550 |
| 13 | 27 | 1 | 4 | 1 | 1 | 34 | 3516 |
| 14 | 36 | 3 | 18 | 1 | 1 | 59 | 3457 |
| 15 | 31 | 0 | 30 | 0 | 0 | 61 | 3396 |
| 16 | 24 | 1 | 89 | 1 | 0 | 115 | 3281 |
| 17 | 30 | 3 | 31 | 2 | 0 | 66 | 3215 |
| 18 | 31 | 1 | 237 | 2 | 0 | 271 | 2944 |
| 19 | 31 | 2 | 873 | 1 | 0 | 907 | 2037 |
| 20 | 36 | 1 | 185 | 1 | 0 | 223 | 1814 |
| 21 | 25 | 2 | 154 | 1 | 1 | 183 | 1631 |
| 22 | 27 | 5 | 122 | 0 | 0 | 154 | 1477 |
| 23 | 17 | 4 | 232 | 1 | 0 | 254 | 1223 |
| 24 | 35 | 7 | 767 | 1 | 0 | 810 | 413 |
| 25 | 17 | 0 | 89 | 0 | 0 | 106 | 307 |
| 26 | 15 | 3 | 33 | 0 | 0 | 51 | 256 |
| 27 | 12 | 1 | 16 | 0 | 0 | 29 | 227 |
| 28 | 10 | 1 | 19 | 0 | 0 | 30 | 197 |
| 29 | 6 | 3 | 6 | 2 | 0 | 17 | 180 |
| 30 | 10 | 0 | 8 | 0 | 0 | 18 | 162 |
| Total Losses | 816 | 38 | 2914 | 20 | 33 | 3821 | |

Two - year Cohort Starting in March 1968

Initial Strength = 3519

| Month after start | Losses by Groups R1 | R2 | R3 | R4 | R5 | Row Total | Number Remaining |
|---|---|---|---|---|---|---|---|
| 1 | 73 | 0 | 0 | 0 | 0 | 73 | 3446 |
| 2 | 53 | 0 | 0 | 1 | 0 | 54 | 3392 |
| 3 | 27 | 0 | 0 | 0 | 0 | 27 | 3365 |
| 4 | 15 | 0 | 0 | 2 | 0 | 17 | 3348 |
| 5 | 19 | 0 | 0 | 1 | 0 | 20 | 3328 |
| 6 | 23 | 0 | 0 | 1 | 0 | 24 | 3304 |
| 7 | 19 | 0 | 1 | 3 | 3 | 26 | 3278 |
| 8 | 23 | 0 | 0 | 1 | 4 | 28 | 3250 |
| 9 | 26 | 0 | 1 | 1 | 3 | 31 | 3219 |
| 10 | 21 | 0 | 1 | 2 | 0 | 24 | 3195 |
| 11 | 24 | 0 | 0 | 1 | 3 | 28. | 3167 |
| 12 | 26 | 1 | 0 | 2 | 4 | 33 | 3134 |
| 13 | 22 | 0 | 9 | 3 | 1 | 35 | 3099 |
| 14 | 37 | 1 | 14 | 2 | 0 | 54 | 3045 |
| 15 | 27 | 3 | 73 | 2 | 0 | 105 | 2940 |
| 16 | 26 | 1 | 22 | 1 | 0 | 50 | 2890 |
| 17 | 18 | 0 | 35 | 1 | 0 | 54 | 2836 |
| 18 | 21 | 1 | 354 | 2 | 0 | 378 | 2458 |
| 19 | 18 | 1 | 525 | 0 | 0 | 544 | 1914 |
| 20 | 19 | 0 | 220 | 0 | 0 | 239 | 1675 |
| 21 | 26 | 3 | 167 | 1 | 0 | 197 | 1478 |
| 22 | 19 | 0 | 185 | 2 | 0 | 206 | 1272 |
| 23 | 27 | 3 | 284 | 2 | 0 | 316 | 956 |
| 24 | 26 | 10 | 571 | 0 | 1 | 608 | 348 |
| 25 | 20 | 1 | 45 | 1 | 0 | 67 | 281 |
| 26 | 13 | 0 | 29 | 1 | 0 | 43 | 238 |
| 27 | 8 | 1 | 22 | 1 | 0 | 32 | 206 |
| 28 | 14 | 1 | 13 | 1 | 0 | 29 | 177 |
| 29 | 0 | 1 | 12 | 2 | 0 | 15 | 162 |
| 30 | 4 | 1 | 6 | 1 | 0 | 12 | 150 |
| Total Losses | 694 | 29 | 2589 | 38 | 19 | 3369 | |

Two - year Cohort Starting in April 1968

Initial Strength = 5834

| Month after start | Losses by Groups R1 | R2 | R3 | R4 | R5 | Row Total | Number Remaining |
|---|---|---|---|---|---|---|---|
| 1 | 141 | 0 | 0 | 0 | 0 | 141 | 5693 |
| 2 | 82 | 0 | 0 | 1 | 0 | 83 | 5610 |
| 3 | 53 | 0 | 0 | 2 | 0 | 55 | 5555 |
| 4 | 28 | 0 | 1 | 2 | 0 | 31 | 5524 |
| 5 | 19 | 0 | 0 | 3 | 0 | 22 | 5502 |
| 6 | 23 | 0 | 0 | 4 | 0 | 27 | 5475 |
| 7 | 34 | 0 | 0 | 3 | 0 | 37 | 5438 |
| 8 | 60 | 0 | 1 | 1 | 5 | 67 | 5371 |
| 9 | 35 | 0 | 0 | 0 | 0 | 35 | 5336 |
| 10 | 52 | 0 | 0 | 2 | 7 | 61 | 5275 |
| 11 | 53 | 0 | 0 | 0 | 9 | 62 | 5213 |
| 12 | 43 | 2 | 1 | 0 | 2 | 48 | 5165 |
| 13 | 53 | 0 | 24 | 1 | 0 | 78 | 5087 |
| 14 | 34 | 0 | 101 | 3 | 0 | 138 | 4949 |
| 15 | 45 | 2 | 18 | 4 | 0 | 69 | 4880 |
| 16 | 50 | 1 | 27 | 0 | 2 | 80 | 4800 |
| 17 | 48 | 1 | 56 | 1 | 0 | 106 | 4694 |
| 18 | 30 | 0 | 610 | 1 | 0 | 641 | 4053 |
| 19 | 33 | 0 | 610 | 0 | 0 | 643 | 3410 |
| 20 | 33 | 0 | 242 | 1 | 0 | 276 | 3134 |
| 21 | 40 | 1 | 323 | 1 | 0 | 365 | 2769 |
| 22 | 41 | 4 | 579 | 2 | 0 | 626 | 2143 |
| 23 | 41 | 4 | 432 | 0 | 0 | 477 | 1666 |
| 24 | 40 | 6 | 1229 | 1 | 0 | 1276 | 390 |
| 25 | 24 | 0 | 69 | 1 | 0 | 94 | 296 |
| 26 | 15 | 1 | 32 | 0 | 0 | 48 | 248 |
| 27 | 14 | 6 | 18 | 2 | 0 | 40 | 208 |
| 28 | 11 | 0 | 9 | 0 | 0 | 20 | 188 |
| 29 | 9 | 0 | 9 | 2 | 0 | 20 | 168 |
| 30 | 5 | 1 | 6 | 0 | 0 | 12 | 156 |
| Total Losses | 1189 | 29 | 4397 | 38 | 25 | 5678 | |

Two - year Cohort Starting in May 1968

Initial Strength = 5299

| Month after start | Losses by Groups R1 | R2 | R3 | R4 | R5 | Row Total | Number Remaining |
|---|---|---|---|---|---|---|---|
| 1 | 142 | 0 | 0 | 2 | 0 | 144 | 5155 |
| 2 | 117 | 0 | 0 | 0 | 0 | 117 | 5038 |
| 3 | 56 | 0 | 0 | 0 | 0 | 56 | 4982 |
| 4 | 27 | 0 | 0 | 0 | 0 | 27 | 4955 |
| 5 | 14 | 0 | 0 | 5 | 0 | 19 | 4936 |
| 6 | 27 | 0 | 0 | 0 | 0 | 27 | 4909 |
| 7 | 33 | 0 | 1 | 0 | 0 | 34 | 4875 |
| 8 | 33 | 0 | 0 | 1 | 0 | 34 | 4841 |
| 9 | 38 | 0 | 0 | 0 | 2 | 40 | 4801 |
| 10 | 36 | 0 | 0 | 3 | 2 | 41 | 4760 |
| 11 | 37 | 0 | 0 | 2 | 3 | 42 | 4718 |
| 12 | 40 | 2 | 1 | 2 | 2 | 47 | 4671 |
| 13 | 29 | 0 | 32 | 2 | 0 | 63 | 4608 |
| 14 | 34 | 1 | 29 | 2 | 0 | 66 | 4542 |
| 15 | 43 | 1 | 20 | 0 | 0 | 64 | 4478 |
| 16 | 42 | 1 | 36 | 4 | 0 | 83 | 4395 |
| 17 | 38 | 0 | 96 | 5 | 1 | 140 | 4255 |
| 18 | 25 | 0 | 609 | 2 | 0 | 636 | 3619 |
| 19 | 29 | 0 | 341 | 0 | 0 | 370 | 3249 |
| 20 | 34 | 0 | 176 | 0 | 0 | 210 | 3039 |
| 21 | 29 | 0 | 524 | 3 | 0 | 556 | 2483 |
| 22 | 39 | 6 | 349 | 1 | 0 | 395 | 2088 |
| 23 | 31 | 5 | 474 | 1 | 0 | 511 | 1577 |
| 24 | 30 | 5 | 1178 | 0 | 0 | 1213 | 364 |
| 25 | 27 | 0 | 65 | 0 | 0 | 92 | 272 |
| 26 | 19 | 2 | 30 | 2 | 0 | 53 | 219 |
| 27 | 11 | 1 | 25 | 2 | 0 | 39 | 180 |
| 28 | 4 | 0 | 18 | 0 | 0 | 22 | 158 |
| 29 | 9 | 0 | 5 | 1 | 0 | 15 | 143 |
| 30 | 6 | 0 | 6 | 0 | 0 | 12 | 131 |
| Total Losses | 1079 | 24 | 4015 | 40 | 10 | 5168 | |

Two - year Cohort Starting in June 1968

Initial Strength = 4023

| Month after start | Losses by Groups R1 | R2 | R3 | R4 | R5 | Row Total | Number Remaining |
|---|---|---|---|---|---|---|---|
| 1 | 110 | 0 | 0 | 1 | 0 | 111 | 3912 |
| 2 | 74 | 0 | 0 | 1 | 0 | 75 | 3837 |
| 3 | 38 | 0 | 0 | 0 | 0 | 38 | 3799 |
| 4 | 16 | 0 | 0 | 1 | 0 | 17 | 3782 |
| 5 | 15 | 0 | 0 | 2 | 0 | 17 | 3765 |
| 6 | 12 | 0 | 1 | 2 | 0 | 15 | 3750 |
| 7 | 21 | 0 | 0 | 1 | 0 | 22 | 3728 |
| 8 | 27 | 0 | 0 | 0 | 1 | 28 | 3700 |
| 9 | 28 | 0 | 0 | 1 | 3 | 32 | 3668 |
| 10 | 20 | 0 | 0 | 2 | 1 | 23 | 3645 |
| 11 | 28 | 0 | 0 | 0 | 0 | 28 | 3617 |
| 12 | 20 | 0 | 0 | 1 | 2 | 23 | 3594 |
| 13 | 33 | 1 | 48 | 1 | 0 | 83 | 3511 |
| 14 | 41 | 0 | 24 | 2 | 1 | 68 | 3443 |
| 15 | 26 | 4 | 27 | 0 | 0 | 57 | 3386 |
| 16 | 32 | 0 | 52 | 2 | 0 | 86 | 3300 |
| 17 | 19 | 1 | 80 | 0 | 0 | 100 | 3200 |
| 18 | 29 | 0 | 517 | 1 | 1 | 548 | 2652 |
| 19 | 30 | 0 | 237 | 0 | 0 | 267 | 2385 |
| 20 | 35 | 0 | 448 | 1 | 0 | 484 | 1901 |
| 21 | 26 | 2 | 236 | 2 | 0 | 266 | 1635 |
| 22 | 31 | 6 | 278 | 2 | 0 | 317 | 1318 |
| 23 | 22 | 5 | 114 | 3 | 0 | 144 | 1174 |
| 24 | 20 | 7 | 850 | 1 | 0 | 878 | 296 |
| 25 | 10 | 2 | 43 | 1 | 0 | 56 | 240 |
| 26 | 17 | 1 | 16 | 1 | 0 | 35 | 205 |
| 27 | 7 | 2 | 15 | 2 | 0 | 26 | 179 |
| 28 | 8 | 0 | 8 | 0 | 0 | 16 | 163 |
| 29 | 6 | 0 | 14 | 0 | 0 | 20 | 143 |
| 30 | 1 | 1 | 3 | 0 | 0 | 5 | 138 |
| Total Losses | 802 | 32 | 3011 | 31 | 9 | 3885 | |

Three - year Cohort Starting in July 1967

Initial Strength = 1752

| Month after start | Losses by Groups R1 | R2 | R3 | R4 | R5 | Row Total | Number Remaining |
|---|---|---|---|---|---|---|---|
| 1 | 26 | 0 | 0 | 0 | 0 | 26 | 1726 |
| 2 | 14 | 0 | 0 | 0 | 0 | 14 | 1712 |
| 3 | 12 | 0 | 0 | 0 | 0 | 12 | 1700 |
| 4 | 10 | 0 | 0 | 1 | 0 | 11 | 1689 |
| 5 | 8 | 0 | 0 | 2 | 0 | 10 | 1679 |
| 6 | 12 | 0 | 0 | 3 | 0 | 15 | 1664 |
| 7 | 16 | 0 | 0 | 1 | 0 | 17 | 1647 |
| 8 | 13 | 0 | 0 | 0 | 1 | 14 | 1633 |
| 9 | 15 | 0 | 0 | 0 | 6 | 21 | 1612 |
| 10 | 24 | 0 | 0 | 1 | 4 | 29 | 1583 |
| 11 | 21 | 0 | 0 | 1 | 0 | 22 | 1561 |
| 12 | 15 | 0 | 0 | 1 | 0 | 16 | 1545 |
| 13 | 8 | 0 | 0 | 0 | 0 | 8 | 1537 |
| 14 | 13 | 0 | 0 | 0 | 0 | 13 | 1524 |
| 15 | 11 | 0 | 0 | 0 | 0 | 11 | 1513 |
| 16 | 18 | 0 | 0 | 1 | 0 | 19 | 1494 |
| 17 | 14 | 0 | 0 | 1 | 0 | 15 | 1479 |
| 18 | 20 | 0 | 0 | 0 | 0 | 20 | 1459 |
| 19 | 10 | 0 | 2 | 0 | 0 | 12 | 1447 |
| 20 | 10 | 0 | 1 | 1 | 0 | 12 | 1435 |
| 21 | 11 | 0 | 0 | 0 | 0 | 11 | 1424 |
| 22 | 13 | 0 | 1 | 1 | 0 | 15 | 1409 |
| 23 | 5 | 0 | 0 | 1 | 0 | 6 | 1403 |
| 24 | 18 | 6 | 6 | 0 | 0 | 30 | 1373 |
| 25 | 12 | 6 | 342 | 2 | 0 | 362 | 1011 |
| 26 | 10 | 2 | 51 | 0 | 0 | 63 | 948 |
| 27 | 12 | 3 | 17 | 1 | 0 | 33 | 915 |
| 28 | 9 | 3 | 7 | 2 | 0 | 21 | 894 |
| 29 | 3 | 2 | 14 | 1 | 1 | 21 | 873 |
| 30 | 4 | 0 | 10 | 0 | 0 | 14 | 859 |
| 31 | 6 | 0 | 235 | 0 | 0 | 241 | 618 |
| 32 | 6 | 1 | 56 | 1 | 0 | 64 | 554 |
| 33 | 8 | 2 | 97 | 0 | 0 | 107 | 447 |
| 34 | 2 | 1 | 38 | 0 | 0 | 41 | 406 |
| 35 | 7 | 0 | 49 | 1 | 0 | 57 | 349 |
| 36 | 7 | 6 | 250 | 1 | 0 | 264 | 85 |
| 37 | 5 | 0 | 24 | 0 | 0 | 29 | 56 |
| 38 | 1 | 0 | 4 | 0 | 0 | 5 | 51 |
| 39 | 4 | 0 | 7 | 0 | 0 | 11 | 40 |
| 40 | 2 | 0 | 2 | 0 | 0 | 4 | 36 |
| Total Losses | 435 | 32 | 1213 | 24 | 12 | 1716 | |

Three - year Cohort Starting in August 1967

Initial Strength = 2134

| Month after start | Losses by Groups R1 | R2 | R3 | R4 | R5 | Row Total | Number Remaining |
|---|---|---|---|---|---|---|---|
| 1 | 32 | 0 | 0 | 0 | 0 | 32 | 2102 |
| 2 | 20 | 0 | 0 | 1 | 0 | 21 | 2081 |
| 3 | 8 | 0 | 0 | 0 | 0 | 8 | 2073 |
| 4 | 11 | 0 | 0 | 0 | 0 | 11 | 2062 |
| 5 | 6 | 0 | 0 | 1 | 0 | 7 | 2055 |
| 6 | 7 | 0 | 0 | 1 | 0 | 8 | 2047 |
| 7 | 11 | 0 | 0 | 1 | 0 | 12 | 2035 |
| 8 | 17 | 0 | 0 | 0 | 2 | 19 | 2016 |
| 9 | 29 | 0 | 1 | 0 | 4 | 34 | 1982 |
| 10 | 16 | 0 | 0 | 1 | 0 | 17 | 1965 |
| 11 | 20 | 0 | 0 | 1 | 0 | 21 | 1944 |
| 12 | 22 | 0 | 0 | 0 | 0 | 22 | 1922 |
| 13 | 20 | 0 | 0 | 0 | 0 | 20 | 1902 |
| 14 | 17 | 0 | 1 | 0 | 0 | 18 | 1884 |
| 15 | 22 | 0 | 0 | 1 | 0 | 23 | 1861 |
| 16 | 13 | 0 | 0 | 0 | 0 | 13 | 1848 |
| 17 | 17 | 0 | 0 | 0 | 0 | 17 | 1831 |
| 18 | 17 | 0 | 1 | 0 | 0 | 18 | 1813 |
| 19 | 19 | 0 | 1 | 0 | 0 | 20 | 1793 |
| 20 | 26 | 0 | 0 | 2 | 0 | 28 | 1765 |
| 21 | 15 | 0 | 1 | 1 | 0 | 17 | 1748 |
| 22 | 8 | 0 | 1 | 0 | 0 | 9 | 1739 |
| 23 | 19 | 0 | 1 | 0 | 0 | 20 | 1719 |
| 24 | 19 | 6 | 25 | 3 | 0 | 53 | 1666 |
| 25 | 15 | 6 | 304 | 2 | 0 | 327 | 1339 |
| 26 | 11 | 2 | 57 | 2 | 0 | 72 | 1267 |
| 27 | 6 | 4 | 20 | 0 | 0 | 30 | 1237 |
| 28 | 8 | 5 | 11 | 2 | 0 | 26 | 1211 |
| 29 | 8 | 2 | 16 | 0 | 0 | 26 | 1185 |
| 30 | 13 | 2 | 203 | 1 | 0 | 219 | 966 |
| 31 | 8 | 3 | 159 | 2 | 0 | 172 | 794 |
| 32 | 10 | 0 | 123 | 1 | 0 | 134 | 660 |
| 33 | 9 | 0 | 46 | 0 | 0 | 55 | 605 |
| 34 | 10 | 1 | 92 | 1 | 0 | 104 | 501 |
| 35 | 3 | 2 | 69 | 0 | 0 | 74 | 427 |
| 36 | 12 | 8 | 298 | 0 | 0 | 318 | 109 |
| 37 | 6 | 1 | 19 | 0 | 0 | 26 | 83 |
| 38 | 5 | 0 | 11 | 2 | 0 | 18 | 65 |
| 39 | 4 | 0 | 4 | 0 | 0 | 8 | 57 |
| 40 | 2 | 0 | 2 | 0 | 0 | 4 | 53 |
| 41 | 1 | 0 | 1 | 0 | 0 | 2 | 51 |
| 42 | 2 | 0 | 0 | 0 | 0 | 2 | 49 |
| 43 | 1 | 0 | 0 | 0 | 0 | 1 | 48 |
| 44 | 2 | 0 | 0 | 1 | 0 | 3 | 45 |
| Total Losses | 547 | 42 | 1467 | 27 | 6 | 2089 | |

Three - year Cohort Starting in September 1967

Initial Strength = 2501

| Month after start | Losses by Groups R1 | R2 | R3 | R4 | R5 | Row Total | Number Remaining |
|---|---|---|---|---|---|---|---|
| 1 | 32 | 0 | 0 | 0 | 0 | 32 | 2469 |
| 2 | 26 | 0 | 0 | 0 | 0 | 26 | 2443 |
| 3 | 20 | 0 | 0 | 0 | 0 | 20 | 2423 |
| 4 | 7 | 0 | 0 | 1 | 0 | 8 | 2415 |
| 5 | 8 | 0 | 0 | 4 | 0 | 12 | 2403 |
| 6 | 13 | 0 | 0 | 2 | 1 | 16 | 2387 |
| 7 | 18 | 0 | 0 | 0 | 1 | 19 | 2368 |
| 8 | 25 | 0 | 0 | 0 | 9 | 34 | 2334 |
| 9 | 11 | 0 | 0 | 0 | 0 | 11 | 2323 |
| 10 | 17 | 0 | 0 | 0 | 0 | 17 | 2306 |
| 11 | 22 | 0 | 1 | 1 | 1 | 25 | 2281 |
| 12 | 9 | 0 | 0 | 0 | 0 | 9 | 2272 |
| 13 | 9 | 0 | 0 | 0 | 4 | 13 | 2259 |
| 14 | 15 | 0 | 0 | 0 | 0 | 15 | 2244 |
| 15 | 20 | 0 | 0 | 0 | 1 | 21 | 2223 |
| 16 | 21 | 0 | 0 | 1 | 0 | 22 | 2201 |
| 17 | 18 | 0 | 0 | 2 | 1 | 21 | 2180 |
| 18 | 17 | 0 | 0 | 1 | 0 | 18 | 2162 |
| 19 | 13 | 0 | 0 | 2 | 0 | 15 | 2147 |
| 20 | 16 | 0 | 0 | 0 | 0 | 16 | 2131 |
| 21 | 9 | 0 | 3 | 3 | 0 | 15 | 2116 |
| 22 | 9 | 1 | 1 | 0 | 0 | 11 | 2105 |
| 23 | 28 | 0 | 3 | 0 | 1 | 32 | 2073 |
| 24 | 19 | 10 | 14 | 2 | 0 | 45 | 2028 |
| 25 | 11 | 8 | 307 | 1 | 0 | 327 | 1701 |
| 26 | 13 | 7 | 66 | 1 | 0 | 87 | 1614 |
| 27 | 10 | 2 | 31 | 1 | 0 | 44 | 1570 |
| 28 | 10 | 1 | 28 | 1 | 0 | 40 | 1530 |
| 29 | 12 | 4 | 195 | 2 | 0 | 213 | 1317 |
| 30 | 11 | 7 | 183 | 1 | 0 | 202 | 1115 |
| 31 | 12 | 2 | 135 | 2 | 0 | 151 | 964 |
| 32 | 12 | 2 | 45 | 0 | 0 | 59 | 905 |
| 33 | 8 | 2 | 87 | 0 | 0 | 97 | 808 |
| 34 | 16 | 4 | 56 | 0 | 0 | 76 | 732 |
| 35 | 8 | 4 | 95 | 0 | 0 | 107 | 625 |
| 36 | 11 | 4 | 426 | 1 | 0 | 442 | 183 |
| 37 | 5 | 1 | 24 | 0 | 0 | 30 | 153 |
| 38 | 4 | 0 | 14 | 0 | 0 | 18 | 135 |
| 39 | 4 | 0 | 16 | 0 | 0 | 20 | 115 |
| 40 | 2 | 0 | 5 | 1 | 0 | 8 | 107 |
| 41 | 6 | 0 | 2 | 0 | 0 | 8 | 99 |
| 42 | 3 | 0 | 5 | 0 | 0 | 8 | 91 |
| 43 | 2 | 0 | 0 | 0 | 0 | 2 | 89 |
| Total Losses | 562 | 59 | 1742 | 30 | 19 | 2412 | |

Three - year Cohort Starting in October 1967

Initial Strength = 919

| Month after start | Losses by Groups R1 | R2 | R3 | R4 | R5 | Row Total | Number Remaining |
|---|---|---|---|---|---|---|---|
| 1 | 21 | 0 | 0 | 0 | 0 | 21 | 898 |
| 2 | 6 | 0 | 0 | 0 | 0 | 6 | 892 |
| 3 | 3 | 0 | 0 | 0 | 0 | 3 | 889 |
| 4 | 2 | 0 | 0 | 1 | 0 | 3 | 886 |
| 5 | 3 | 0 | 0 | 0 | 0 | 3 | 883 |
| 6 | 7 | 0 | 0 | 1 | 0 | 8 | 875 |
| 7 | 8 | 0 | 0 | 1 | 5 | 14 | 861 |
| 8 | 6 | 0 | 1 | 1 | 0 | 8 | 853 |
| 9 | 7 | 0 | 0 | 0 | 0 | 7 | 846 |
| 10 | 7 | 0 | 0 | 0 | 3 | 10 | 836 |
| 11 | 8 | 0 | 0 | 0 | 0 | 8 | 828 |
| 12 | 4 | 0 | 0 | 0 | 0 | 4 | 824 |
| 13 | 2 | 0 | 0 | 0 | 2 | 4 | 820 |
| 14 | 3 | 0 | 0 | 0 | 0 | 3 | 817 |
| 15 | 6 | 0 | 0 | 0 | 0 | 6 | 811 |
| 16 | 7 | 0 | 0 | 0 | 0 | 7 | 804 |
| 17 | 7 | 0 | 0 | 0 | 0 | 7 | 797 |
| 18 | 4 | 0 | 0 | 0 | 0 | 4 | 793 |
| 19 | 4 | 0 | 1 | 0 | 0 | 5 | 788 |
| 20 | 5 | 0 | 2 | 1 | 0 | 8 | 780 |
| 21 | 12 | 0 | 0 | 0 | 0 | 12 | 768 |
| 22 | 4 | 0 | 0 | 0 | 0 | 4 | 764 |
| 23 | 7 | 0 | 0 | 0 | 0 | 7 | 757 |
| 24 | 7 | 0 | 6 | 1 | 0 | 14 | 743 |
| 25 | 3 | 0 | 77 | 0 | 0 | 80 | 663 |
| 26 | 10 | 1 | 28 | 0 | 0 | 39 | 624 |
| 27 | 6 | 1 | 11 | 1 | 0 | 19 | 605 |
| 28 | 13 | 1 | 66 | 0 | 0 | 80 | 525 |
| 29 | 12 | 1 | 75 | 0 | 0 | 88 | 437 |
| 30 | 7 | 0 | 58 | 0 | 0 | 65 | 372 |
| 31 | 6 | 0 | 10 | 0 | 0 | 16 | 356 |
| 32 | 6 | 0 | 16 | 0 | 0 | 22 | 334 |
| 33 | 1 | 0 | 27 | 0 | 0 | 28 | 306 |
| 34 | 6 | 4 | 43 | 0 | 0 | 53 | 253 |
| 35 | 3 | 0 | 42 | 0 | 0 | 45 | 208 |
| 36 | 5 | 5 | 148 | 0 | 0 | 158 | 50 |
| 37 | 3 | 0 | 7 | 0 | 0 | 10 | 40 |
| 38 | 2 | 0 | 4 | 0 | 0 | 6 | 34 |
| 39 | 1 | 0 | 1 | 1 | 0 | 3 | 31 |
| 40 | 1 | 0 | 0 | 0 | 0 | 1 | 30 |
| 41 | 1 | 0 | 0 | 1 | 0 | 2 | 28 |
| Total Losses | 236 | 13 | 623 | 9 | 10 | 891 | |

Three - year Cohort Starting in November 1967

Initial Strength = 776

| Month after start | Losses by Groups R1 | R2 | R3 | R4 | R5 | Row Total | Number Remaining |
|---|---|---|---|---|---|---|---|
| 1 | 23 | 0 | 0 | 0 | 0 | 23 | 753 |
| 2 | 1 | 0 | 0 | 0 | 0 | 1 | 752 |
| 3 | 2 | 0 | 0 | 0 | 0 | 2 | 750 |
| 4 | 2 | 0 | 0 | 1 | 0 | 3 | 747 |
| 5 | 0 | 0 | 0 | 1 | 0 | 1 | 746 |
| 6 | 7 | 0 | 0 | 1 | 0 | 8 | 738 |
| 7 | 2 | 0 | 0 | 2 | 0 | 4 | 734 |
| 8 | 4 | 0 | 0 | 0 | 0 | 4 | 730 |
| 9 | 4 | 0 | 0 | 0 | 0 | 4 | 726 |
| 10 | 5 | 0 | 0 | 1 | 0 | 6 | 720 |
| 11 | 3 | 0 | 0 | 0 | 0 | 3 | 717 |
| 12 | 4 | 0 | 0 | 0 | 0 | 4 | 713 |
| 13 | 3 | 0 | 0 | 0 | 1 | 4 | 709 |
| 14 | 9 | 0 | 0 | 0 | 0 | 9 | 700 |
| 15 | 9 | 0 | 0 | 0 | 0 | 9 | 691 |
| 16 | 8 | 0 | 0 | 0 | 0 | 8 | 683 |
| 17 | 6 | 0 | 0 | 0 | 0 | 6 | 677 |
| 18 | 8 | 0 | 0 | 0 | 0 | 8 | 669 |
| 19 | 3 | 0 | 0 | 0 | 0 | 3 | 666 |
| 20 | 8 | 0 | 1 | 1 | 0 | 10 | 656 |
| 21 | 5 | 0 | 0 | 1 | 0 | 6 | 650 |
| 22 | 7 | 0 | 0 | 1 | 0 | 8 | 642 |
| 23 | 10 | 0 | 3 | 0 | 0 | 13 | 629 |
| 24 | 5 | 2 | 10 | 0 | 0 | 17 | 612 |
| 25 | 11 | 4 | 116 | 0 | 0 | 131 | 481 |
| 26 | 8 | 0 | 12 | 0 | 0 | 20 | 461 |
| 27 | 3 | 0 | 31 | 0 | 0 | 34 | 427 |
| 28 | 6 | 3 | 29 | 0 | 0 | 38 | 389 |
| 29 | 13 | 2 | 51 | 1 | 0 | 67 | 322 |
| 30 | 8 | 0 | 5 | 1 | 0 | 14 | 308 |
| 31 | 5 | 1 | 7 | 0 | 0 | 13 | 295 |
| 32 | 5 | 2 | 8 | 0 | 0 | 15 | 280 |
| 33 | 8 | 2 | 30 | 0 | 0 | 40 | 240 |
| 34 | 3 | 0 | 39 | 0 | 0 | 42 | 198 |
| 35 | 2 | 2 | 51 | 0 | 0 | 55 | 143 |
| 36 | 2 | 2 | 87 | 0 | 0 | 91 | 52 |
| 37 | 1 | 0 | 16 | 0 | 0 | 17 | 35 |
| 38 | 3 | 0 | 4 | 0 | 0 | 7 | 28 |
| 39 | 0 | 0 | 4 | 0 | 0 | 4 | 24 |
| 40 | 1 | 0 | 1 | 0 | 0 | 2 | 22 |
| 41 | 0 | 0 | 1 | 0 | 0 | 1 | 21 |
| Total Losses | 217 | 20 | 506 | 11 | 1 | 755 | |

Three - year Cohort Starting in December 1967

Initial Strength = 767

| Month after start | Losses by Groups R1 | R2 | R3 | R4 | R5 | Row Total | Number Remaining |
|---|---|---|---|---|---|---|---|
| 1 | 9 | 0 | 1 | 0 | 0 | 10 | 757 |
| 2 | 11 | 0 | 0 | 0 | 0 | 11 | 746 |
| 3 | 1 | 0 | 0 | 0 | 0 | 1 | 745 |
| 4 | 3 | 0 | 0 | 1 | 0 | 4 | 741 |
| 5 | 2 | 0 | 0 | 0 | 0 | 2 | 739 |
| 6 | 3 | 0 | 0 | 0 | 0 | 3 | 736 |
| 7 | 1 | 0 | 0 | 0 | 0 | 1 | 735 |
| 8 | 6 | 0 | 0 | 1 | 2 | 9 | 726 |
| 9 | 5 | 0 | 0 | 0 | 0 | 5 | 721 |
| 10 | 2 | 0 | 0 | 0 | 2 | 4 | 717 |
| 11 | 8 | 0 | 0 | 0 | 0 | 8 | 709 |
| 12 | 6 | 0 | 0 | 0 | 0 | 6 | 703 |
| 13 | 2 | 0 | 0 | 0 | 0 | 2 | 701 |
| 14 | 6 | 0 | 0 | 0 | 0 | 6 | 695 |
| 15 | 6 | 0 | 0 | 0 | 0 | 6 | 689 |
| 16 | 9 | 0 | 0 | 0 | 0 | 9 | 680 |
| 17 | 8 | 0 | 0 | 0 | 0 | 8 | 672 |
| 18 | 6 | 0 | 0 | 1 | 0 | 7 | 665 |
| 19 | 8 | 0 | 0 | 1 | 0 | 9 | 656 |
| 20 | 9 | 0 | 0 | 0 | 0 | 9 | 647 |
| 21 | 7 | 0 | 0 | 0 | 0 | 7 | 640 |
| 22 | 4 | 0 | 1 | 0 | 0 | 5 | 635 |
| 23 | 2 | 0 | 0 | 1 | 0 | 3 | 632 |
| 24 | 8 | 1 | 3 | 0 | 0 | 12 | 620 |
| 25 | 5 | 1 | 56 | 2 | 0 | 64 | 556 |
| 26 | 8 | 1 | 40 | 0 | 0 | 49 | 507 |
| 27 | 8 | 2 | 25 | 0 | 0 | 35 | 472 |
| 28 | 8 | 1 | 57 | 1 | 0 | 67 | 405 |
| 29 | 10 | 0 | 50 | 2 | 0 | 62 | 343 |
| 30 | 3 | 0 | 15 | 0 | 0 | 18 | 325 |
| 31 | 4 | 1 | 6 | 0 | 0 | 11 | 314 |
| 32 | 4 | 0 | 17 | 0 | 0 | 21 | 293 |
| 33 | 1 | 2 | 27 | 0 | 0 | 30 | 263 |
| 34 | 4 | 0 | 15 | 1 | 0 | 20 | 243 |
| 35 | 5 | 1 | 37 | 0 | 0 | 43 | 200 |
| 36 | 5 | 2 | 122 | 0 | 0 | 129 | 71 |
| 37 | 3 | 0 | 9 | 0 | 0 | 12 | 59 |
| 38 | 0 | 0 | 2 | 0 | 0 | 2 | 57 |
| 39 | 2 | 0 | 4 | 1 | 0 | 7 | 50 |
| 40 | 1 | 0 | 0 | 0 | 0 | 1 | 49 |
| Total Losses | 203 | 12 | 487 | 12 | 4 | 718 | |

Four - year Cohort Starting in July 1967

Initial Strength = 5378

| Month after start | Losses by Groups R1 | R2 | R3 | R4 | R5 | Row Total | Number Remaining |
|---|---|---|---|---|---|---|---|
| 1 | 86 | 0 | 0 | 1 | 0 | 87 | 5291 |
| 2 | 48 | 0 | 0 | 0 | 0 | 48 | 5243 |
| 3 | 38 | 0 | 0 | 0 | 0 | 38 | 5205 |
| 4 | 19 | 0 | 0 | 1 | 0 | 20 | 5185 |
| 5 | 20 | 0 | 1 | 0 | 0 | 21 | 5164 |
| 6 | 41 | 0 | 0 | 2 | 1 | 44 | 5120 |
| 7 | 43 | 0 | 0 | 1 | 3 | 47 | 5073 |
| 8 | 40 | 0 | 0 | 1 | 6 | 47 | 5026 |
| 9 | 42 | 0 | 0 | 1 | 3 | 46 | 4980 |
| 10 | 79 | 0 | 0 | 1 | 5 | 85 | 4895 |
| 11 | 50 | 0 | 0 | 3 | 0 | 53 | 4842 |
| 12 | 37 | 0 | 0 | 0 | 0 | 37 | 4805 |
| 13 | 52 | 0 | 0 | 2 | 1 | 55 | 4750 |
| 14 | 35 | 0 | 0 | 0 | 0 | 35 | 4715 |
| 15 | 23 | 0 | 0 | 1 | 4 | 28 | 4687 |
| 16 | 39 | 0 | 0 | 2 | 0 | 41 | 4646 |
| 17 | 39 | 0 | 1 | 2 | 0 | 42 | 4604 |
| 18 | 35 | 0 | 1 | 1 | 0 | 37 | 4567 |
| 19 | 43 | 0 | 0 | 1 | 0 | 44 | 4523 |
| 20 | 35 | 0 | 0 | 2 | 0 | 37 | 4486 |
| 21 | 31 | 1 | 0 | 2 | 1 | 35 | 4451 |
| 22 | 35 | 0 | 2 | 0 | 0 | 37 | 4414 |
| 23 | 29 | 0 | 0 | 3 | 0 | 32 | 4382 |
| 24 | 32 | 0 | 1 | 1 | 0 | 34 | 4348 |
| 25 | 26 | 0 | 6 | 2 | 0 | 34 | 4314 |
| 26 | 45 | 0 | 3 | 2 | 0 | 50 | 4264 |
| 27 | 44 | 0 | 1 | 3 | 0 | 48 | 4216 |
| 28 | 38 | 0 | 0 | 1 | 0 | 39 | 4177 |
| 29 | 24 | 0 | 0 | 1 | 0 | 25 | 4152 |
| 30 | 21 | 0 | 0 | 2 | 0 | 23 | 4129 |
| 31 | 42 | 0 | 2 | 2 | 0 | 46 | 4083 |
| 32 | 51 | 0 | 18 | 0 | 0 | 69 | 4014 |
| 33 | 54 | 0 | 133 | 6 | 0 | 193 | 3821 |
| 34 | 41 | 0 | 890 | 3 | 0 | 934 | 2887 |
| 35 | 47 | 0 | 128 | 4 | 0 | 179 | 2708 |
| 36 | 28 | 38 | 70 | 2 | 0 | 138 | 2570 |
| 37 | 25 | 39 | 68 | 3 | 0 | 135 | 2435 |
| 38 | 13 | 23 | 36 | 3 | 0 | 75 | 2360 |
| 39 | 27 | 8 | 30 | 1 | 0 | 66 | 2294 |
| 40 | 18 | 11 | 17 | 2 | 0 | 48 | 2246 |
| 41 | 25 | 11 | 101 | 2 | 0 | 139 | 2107 |
| 42 | 16 | 7 | 3 | 1 | 0 | 27 | 2080 |
| 43 | 13 | 7 | 1 | 2 | 0 | 23 | 2057 |
| 44 | 11 | 2 | 13 | 1 | 0 | 27 | 2030 |
| Total Losses | 1580 | 147 | 1526 | 71 | 24 | 3348 | |

Four - year Cohort Starting in August 1967

Initial Strength = 4198

| Month after start | Losses by Groups R1 | R2 | R3 | R4 | R5 | Row Total | Number Remaining |
|---|---|---|---|---|---|---|---|
| 1 | 79 | 0 | 0 | 0 | 0 | 79 | 4119 |
| 2 | 51 | 0 | 0 | 0 | 0 | 51 | 4068 |
| 3 | 23 | 0 | 0 | 1 | 0 | 24 | 4044 |
| 4 | 19 | 0 | 0 | 3 | 0 | 22 | 4022 |
| 5 | 12 | 0 | 0 | 1 | 0 | 13 | 4009 |
| 6 | 30 | 0 | 0 | 2 | 0 | 32 | 3977 |
| 7 | 36 | 0 | 0 | 2 | 1 | 39 | 3938 |
| 8 | 26 | 0 | 0 | 1 | 0 | 27 | 3911 |
| 9 | 50 | 0 | 0 | 0 | 7 | 57 | 3854 |
| 10 | 22 | 0 | 0 | 0 | 0 | 22 | 3832 |
| 11 | 26 | 0 | 0 | 3 | 0 | 29 | 3803 |
| 12 | 33 | 0 | 0 | 1 | 2 | 36 | 3767 |
| 13 | 27 | 0 | 0 | 2 | 0 | 29 | 3738 |
| 14 | 28 | 0 | 0 | 1 | 0 | 29 | 3709 |
| 15 | 27 | 0 | 0 | 0 | 1 | 28 | 3681 |
| 16 | 31 | 0 | 0 | 3 | 1 | 35 | 3646 |
| 17 | 33 | 0 | 0 | 1 | 0 | 34 | 3612 |
| 18 | 30 | 0 | 0 | 0 | 0 | 30 | 3582 |
| 19 | 23 | 0 | 0 | 0 | 0 | 23 | 3559 |
| 20 | 20 | 0 | 2 | 0 | 0 | 22 | 3537 |
| 21 | 29 | 1 | 1 | 4 | 0 | 35 | 3502 |
| 22 | 23 | 0 | 1 | 1 | 0 | 25 | 3477 |
| 23 | 32 | 1 | 0 | 4 | 0 | 37 | 3440 |
| 24 | 32 | 0 | 0 | 1 | 0 | 33 | 3407 |
| 25 | 31 | 0 | 0 | 2 | 0 | 33 | 3374 |
| 26 | 24 | 0 | 1 | 1 | 0 | 26 | 3348 |
| 27 | 20 | 0 | 0 | 3 | 0 | 23 | 3325 |
| 28 | 30 | 0 | 1 | 3 | 0 | 34 | 3291 |
| 29 | 28 | 0 | 2 | 2 | 0 | 32 | 3259 |
| 30 | 26 | 0 | 1 | 2 | 0 | 29 | 3230 |
| 31 | 45 | 0 | 10 | 2 | 0 | 57 | 3173 |
| 32 | 36 | 0 | 25 | 3 | 0 | 64 | 3109 |
| 33 | 35 | 0 | 227 | 1 | 0 | 263 | 2846 |
| 34 | 30 | 0 | 443 | 2 | 0 | 475 | 2371 |
| 35 | 49 | 0 | 97 | 5 | 0 | 151 | 2220 |
| 36 | 25 | 28 | 70 | 2 | 0 | 125 | 2095 |
| 37 | 28 | 22 | 36 | 1 | 0 | 87 | 2008 |
| 38 | 16 | 12 | 23 | 2 | 0 | 53 | 1955 |
| 39 | 13 | 16 | 12 | 1 | 0 | 42 | 1913 |
| 40 | 29 | 12 | 20 | 1 | 0 | 62 | 1851 |
| 41 | 14 | 9 | 2 | 4 | 0 | 29 | 1822 |
| 42 | 15 | 9 | 0 | 1 | 0 | 25 | 1797 |
| 43 | 17 | 5 | 3 | 6 | 0 | 31 | 1766 |
| 44 | 7 | 3 | 8 | 3 | 0 | 21 | 1745 |
| Total Losses | 1260 | 118 | 985 | 78 | 12 | 2453 | |

Four - year Cohort Starting in September 1967

Initial Strength = 4045

| Month after start | Losses by Groups R1 | R2 | R3 | R4 | R5 | Row Total | Number Remaining |
|---|---|---|---|---|---|---|---|
| 1 | 68 | 0 | 0 | 0 | 0 | 68 | 3977 |
| 2 | 39 | 0 | 0 | 0 | 0 | 39 | 3938 |
| 3 | 16 | 0 | 0 | 0 | 0 | 16 | 3922 |
| 4 | 7 | 0 | 0 | 3 | 0 | 10 | 3912 |
| 5 | 12 | 0 | 0 | 0 | 0 | 12 | 3900 |
| 6 | 24 | 0 | 0 | 1 | 2 | 27 | 3873 |
| 7 | 24 | 0 | 0 | 2 | 1 | 27 | 3846 |
| 8 | 47 | 0 | 0 | 1 | 14 | 62 | 3784 |
| 9 | 20 | 0 | 0 | 1 | 0 | 21 | 3763 |
| 10 | 19 | 0 | 0 | 2 | 1 | 22 | 3741 |
| 11 | 28 | 0 | 1 | 1 | 9 | 39 | 3702 |
| 12 | 19 | 0 | 0 | 2 | 0 | 21 | 3681 |
| 13 | 20 | 0 | 0 | 3 | 2 | 25 | 3656 |
| 14 | 21 | 0 | 0 | 0 | 0 | 21 | 3635 |
| 15 | 24 | 0 | 0 | 1 | 2 | 27 | 3608 |
| 16 | 23 | 0 | 0 | 3 | 0 | 26 | 3582 |
| 17 | 22 | 0 | 0 | 3 | 0 | 25 | 3557 |
| 18 | 22 | 0 | 0 | 2 | 0 | 24 | 3533 |
| 19 | 34 | 0 | 0 | 1 | 0 | 35 | 3498 |
| 20 | 20 | 0 | 0 | 0 | 0 | 20 | 3478 |
| 21 | 16 | 0 | 2 | 1 | 1 | 20 | 3458 |
| 22 | 22 | 0 | 0 | 1 | 0 | 23 | 3435 |
| 23 | 27 | 0 | 1 | 2 | 0 | 30 | 3405 |
| 24 | 29 | 0 | 1 | 5 | 0 | 35 | 3370 |
| 25 | 32 | 0 | 0 | 3 | 2 | 37 | 3333 |
| 26 | 25 | 0 | 0 | 1 | 1 | 27 | 3306 |
| 27 | 22 | 0 | 1 | 4 | 1 | 28 | 3278 |
| 28 | 22 | 0 | 0 | 0 | 0 | 22 | 3256 |
| 29 | 24 | 0 | 2 | 2 | 1 | 29 | 3227 |
| 30 | 45 | 0 | 10 | 3 | 1 | 59 | 3168 |
| 31 | 48 | 0 | 21 | 2 | 0 | 71 | 3097 |
| 32 | 43 | 0 | 6 | 2 | 0 | 51 | 3046 |
| 33 | 45 | 0 | 37 | 4 | 0 | 86 | 2960 |
| 34 | 48 | 0 | 463 | 2 | 0 | 513 | 2447 |
| 35 | 26 | 0 | 107 | 3 | 0 | 136 | 2311 |
| 36 | 27 | 31 | 49 | 1 | 0 | 108 | 2203 |
| 37 | 23 | 15 | 32 | 2 | 0 | 72 | 2131 |
| 38 | 27 | 16 | 25 | 0 | 0 | 68 | 2063 |
| 39 | 21 | 17 | 20 | 1 | 0 | 59 | 2004 |
| 40 | 18 | 8 | 1 | 2 | 0 | 29 | 1975 |
| 41 | 13 | 10 | 1 | 1 | 0 | 25 | 1950 |
| 42 | 8 | 9 | 0 | 5 | 0 | 22 | 1928 |
| 43 | 12 | 8 | 0 | 2 | 0 | 22 | 1906 |
| Total Losses | 1132 | 114 | 780 | 75 | 38 | 2139 | |

Four - year Cohort Starting in October 1967

Initial Strength = 2554

| Month after start | Losses by Groups R1 | R2 | R3 | R4 | R5 | Row Total | Number Remaining |
|---|---|---|---|---|---|---|---|
| 1 | 43 | 0 | 0 | 0 | 0 | 43 | 2511 |
| 2 | 27 | 0 | 0 | 0 | 0 | 27 | 2484 |
| 3 | 16 | 0 | 0 | 0 | 0 | 16 | 2468 |
| 4 | 7 | 0 | 0 | 0 | 0 | 7 | 2461 |
| 5 | 6 | 0 | 0 | 0 | 0 | 6 | 2455 |
| 6 | 11 | 0 | 0 | 2 | 0 | 13 | 2442 |
| 7 | 28 | 0 | 0 | 1 | 7 | 36 | 2406 |
| 8 | 14 | 0 | 0 | 1 | 0 | 15 | 2391 |
| 9 | 12 | 0 | 0 | 1 | 1 | 14 | 2377 |
| 10 | 17 | 0 | 0 | 2 | 7 | 26 | 2351 |
| 11 | 14 | 0 | 1 | 1 | 0 | 16 | 2335 |
| 12 | 5 | 0 | 0 | 1 | 1 | 7 | 2328 |
| 13 | 16 | 0 | 0 | 0 | 2 | 18 | 2310 |
| 14 | 12 | 0 | 0 | 0 | 0 | 12 | 2298 |
| 15 | 17 | 0 | 0 | 0 | 1 | 18 | 2280 |
| 16 | 14 | 0 | 0 | 3 | 1 | 18 | 2262 |
| 17 | 16 | 0 | 0 | 1 | 0 | 17 | 2245 |
| 18 | 16 | 0 | 1 | 0 | 2 | 19 | 2226 |
| 19 | 19 | 0 | 1 | 1 | 0 | 21 | 2205 |
| 20 | 9 | 0 | 1 | 2 | 0 | 12 | 2193 |
| 21 | 21 | 0 | 1 | 4 | 0 | 26 | 2167 |
| 22 | 11 | 0 | 0 | 0 | 1 | 12 | 2155 |
| 23 | 22 | 0 | 1 | 2 | 0 | 25 | 2130 |
| 24 | 14 | 0 | 2 | 4 | 0 | 20 | 2110 |
| 25 | 16 | 0 | 0 | 0 | 0 | 16 | 2094 |
| 26 | 10 | 0 | 2 | 1 | 0 | 13 | 2081 |
| 27 | 20 | 0 | 0 | 0 | 0 | 20 | 2061 |
| 28 | 29 | 0 | 1 | 2 | 0 | 32 | 2029 |
| 29 | 29 | 0 | 9 | 2 | 0 | 40 | 1989 |
| 30 | 33 | 0 | 15 | 1 | 0 | 49 | 1940 |
| 31 | 19 | 0 | 8 | 3 | 0 | 30 | 1910 |
| 32 | 24 | 0 | 5 | 1 | 0 | 30 | 1880 |
| 33 | 28 | 1 | 18 | 4 | 0 | 51 | 1829 |
| 34 | 19 | 0 | 248 | 2 | 0 | 269 | 1560 |
| 35 | 12 | 0 | 65 | 5 | 0 | 82 | 1478 |
| 36 | 16 | 18 | 20 | 0 | 0 | 54 | 1424 |
| 37 | 15 | 12 | 17 | 2 | 0 | 46 | 1378 |
| 38 | 12 | 13 | 18 | 3 | 0 | 46 | 1332 |
| 39 | 13 | 8 | 1 | 1 | 0 | 23 | 1309 |
| 40 | 18 | 6 | 0 | 2 | 0 | 26 | 1283 |
| 41 | 9 | 5 | 0 | 3 | 0 | 17 | 1266 |
| 42 | 7 | 4 | 1 | 1 | 0 | 13 | 1253 |
| Total Losses | 716 | 67 | 436 | 59 | 23 | 1301 | |

Four - year Cohort Starting in November 1967

Initial Strength = 2517

| Month after start | Losses by Groups R1 | R2 | R3 | R4 | R5 | Row Total | Number Remaining |
|---|---|---|---|---|---|---|---|
| 1 | 50 | 0 | 0 | 0 | 0 | 50 | 2467 |
| 2 | 37 | 0 | 0 | 0 | 0 | 37 | 2430 |
| 3 | 13 | 0 | 0 | 0 | 0 | 13 | 2417 |
| 4 | 7 | 0 | 0 | 1 | 0 | 8 | 2409 |
| 5 | 5 | 0 | 0 | 1 | 0 | 6 | 2403 |
| 6 | 20 | 0 | 0 | 3 | 2 | 25 | 2378 |
| 7 | 16 | 0 | 0 | 0 | 0 | 16 | 2362 |
| 8 | 15 | 0 | 1 | 0 | 0 | 16 | 2346 |
| 9 | 14 | 0 | 0 | 0 | 11 | 25 | 2321 |
| 10 | 12 | 0 | 0 | 1 | 0 | 13 | 2308 |
| 11 | 15 | 0 | 0 | 0 | 0 | 15 | 2293 |
| 12 | 10 | 0 | 0 | 0 | 0 | 10 | 2283 |
| 13 | 23 | 0 | 0 | 1 | 2 | 26 | 2257 |
| 14 | 11 | 0 | 0 | 3 | 0 | 14 | 2243 |
| 15 | 25 | 0 | 0 | 0 | 1 | 26 | 2217 |
| 16 | 18 | 0 | 0 | 1 | 0 | 19 | 2198 |
| 17 | 19 | 0 | 0 | 0 | 0 | 19 | 2179 |
| 18 | 26 | 0 | 0 | 2 | 0 | 28 | 2151 |
| 19 | 16 | 0 | 0 | 0 | 0 | 16 | 2135 |
| 20 | 17 | 0 | 0 | 1 | 0 | 18 | 2117 |
| 21 | 23 | 0 | 0 | 2 | 0 | 25 | 2092 |
| 22 | 21 | 0 | 1 | 2 | 0 | 24 | 2068 |
| 23 | 19 | 0 | 0 | 3 | 1 | 23 | 2045 |
| 24 | 20 | 0 | 0 | 0 | 2 | 22 | 2023 |
| 25 | 25 | 0 | 0 | 1 | 0 | 26 | 1997 |
| 26 | 24 | 0 | 1 | 1 | 0 | 26 | 1971 |
| 27 | 22 | 0 | 0 | 1 | 0 | 23 | 1948 |
| 28 | 29 | 0 | 0 | 0 | 0 | 29 | 1919 |
| 29 | 32 | 0 | 11 | 1 | 0 | 44 | 1875 |
| 30 | 29 | 0 | 11 | 0 | 1 | 41 | 1834 |
| 31 | 28 | 0 | 11 | 4 | 0 | 43 | 1791 |
| 32 | 21 | 0 | 16 | 0 | 0 | 37 | 1754 |
| 33 | 26 | 0 | 41 | 2 | 0 | 69 | 1685 |
| 34 | 14 | 0 | 254 | 0 | 0 | 268 | 1417 |
| 35 | 18 | 1 | 50 | 1 | 0 | 70 | 1347 |
| 36 | 20 | 10 | 18 | 1 | 0 | 49 | 1298 |
| 37 | 23 | 18 | 19 | 5 | 0 | 65 | 1233 |
| 38 | 18 | 8 | 1 | 5 | 0 | 32 | 1201 |
| 39 | 13 | 9 | 0 | 1 | 0 | 23 | 1178 |
| 40 | 12 | 8 | 0 | 4 | 1 | 25 | 1153 |
| 41 | 3 | 2 | 0 | 1 | 0 | 6 | 1147 |
| Total Losses | 809 | 56 | 435 | 49 | 21 | 1370 | |

Four - year Cohort Starting in December 1967

Initial Strength = 2430

| Month after start | Losses by Groups R1 | R2 | R3 | R4 | R5 | Row Total | Number Remaining |
|---|---|---|---|---|---|---|---|
| 1 | 47 | 0 | 0 | 0 | 0 | 47 | 2383 |
| 2 | 36 | 0 | 0 | 0 | 0 | 36 | 2347 |
| 3 | 11 | 0 | 0 | 0 | 0 | 11 | 2336 |
| 4 | 8 | 0 | 0 | 0 | 0 | 8 | 2328 |
| 5 | 10 | 0 | 1 | 0 | 0 | 11 | 2317 |
| 6 | 11 | 0 | 0 | 3 | 0 | 14 | 2303 |
| 7 | 5 | 0 | 0 | 5 | 0 | 10 | 2293 |
| 8 | 12 | 0 | 0 | 2 | 5 | 19 | 2274 |
| 9 | 9 | 0 | 0 | 3 | 0 | 12 | 2262 |
| 10 | 6 | 0 | 1 | 1 | 2 | 10 | 2252 |
| 11 | 12 | 0 | 0 | 5 | 1 | 18 | 2234 |
| 12 | 11 | 0 | 1 | 1 | 0 | 13 | 2221 |
| 13 | 15 | 0 | 0 | 2 | 0 | 17 | 2204 |
| 14 | 23 | 0 | 0 | 0 | 2 | 25 | 2179 |
| 15 | 13 | 1 | 0 | 1 | 0 | 15 | 2164 |
| 16 | 14 | 0 | 0 | 2 | 0 | 16 | 2148 |
| 17 | 13 | 0 | 0 | 1 | 0 | 14 | 2134 |
| 18 | 20 | 0 | 0 | 2 | 0 | 22 | 2112 |
| 19 | 11 | 0 | 0 | 0 | 0 | 11 | 2101 |
| 20 | 18 | 0 | 0 | 2 | 0 | 20 | 2081 |
| 21 | 19 | 0 | 0 | 0 | 0 | 19 | 2062 |
| 22 | 20 | 0 | 0 | 3 | 1 | 24 | 2038 |
| 23 | 13 | 0 | 0 | 1 | 0 | 14 | 2024 |
| 24 | 17 | 0 | 0 | 2 | 0 | 19 | 2005 |
| 25 | 16 | 0 | 0 | 6 | 0 | 22 | 1983 |
| 26 | 15 | 0 | 1 | 1 | 0 | 17 | 1966 |
| 27 | 26 | 0 | 1 | 0 | 1 | 28 | 1938 |
| 28 | 32 | 0 | 0 | 1 | 0 | 33 | 1905 |
| 29 | 34 | 0 | 5 | 3 | 0 | 42 | 1863 |
| 30 | 20 | 0 | 7 | 1 | 0 | 28 | 1835 |
| 31 | 32 | 0 | 13 | 7 | 0 | 52 | 1783 |
| 32 | 28 | 0 | 12 | 1 | 0 | 41 | 1742 |
| 33 | 15 | 0 | 13 | 2 | 0 | 30 | 1712 |
| 34 | 27 | 0 | 124 | 4 | 0 | 155 | 1557 |
| 35 | 15 | 0 | 30 | 1 | 0 | 46 | 1511 |
| 36 | 27 | 14 | 31 | 1 | 0 | 73 | 1438 |
| 37 | 15 | 20 | 1 | 1 | 0 | 37 | 1401 |
| 38 | 24 | 9 | 2 | 2 | 0 | 37 | 1364 |
| 39 | 15 | 3 | 0 | 2 | 0 | 20 | 1344 |
| 40 | 9 | 6 | 1 | 1 | 0 | 17 | 1327 |
| Total Losses | 724 | 53 | 244 | 70 | 12 | 1103 | |

| COHORT | | INITIAL COHORT STRENGTH | | |
|---|---|---|---|---|
| Year | Month | Two-year | Three-year | Four-year |
| 1967 | Jan | 24 | 1104 | 2801 |
| | Feb | 20 | 553 | 1914 |
| | Mar | 19 | 586 | 2926 |
| | Apr | 6 | 626 | 3431 |
| | May | 252 | 910 | 4855 |
| | Jun | 1107 | 1669 | 6617 |
| | Jul | 1725 | 1752 | 5378 |
| | Aug | 1822 | 2134 | 4198 |
| | Sep | 1848 | 2501 | 4045 |
| | Oct | 2034 | 919 | 2554 |
| | Nov | 2174 | 776 | 2517 |
| | Dec | 2367 | 767 | 2430 |
| 1968 | Jan | 4117 | 1203 | 3305 |
| | Feb | 3983 | 1087 | 2933 |
| | Mar | 3519 | 1102 | 2940 |
| | Apr | 5834 | 840 | 2234 |
| | May | 5299 | 1244 | 2515 |
| | Jun | 4023 | 1838 | 3505 |
| | Jul | 3287 | 1646 | 2633 |
| | Aug | 3484 | 1631 | 2483 |
| | Sep | 3493 | 1726 | 2354 |
| | Oct | 3987 | 1601 | 2397 |
| | Nov | 3490 | 1386 | 2055 |
| | Dec | 5516 | 944 | 1940 |
| 1969 | Jan | 4950 | 886 | 1825 |
| | Feb | 3862 | 664 | 1633 |
| | Mar | 3450 | 1062 | 1853 |
| | Apr | 2800 | 914 | 1567 |
| | May | 3077 | 902 | 1533 |
| | Jun | 3165 | 1515 | 2622 |
| | Jul | 4434 | 1688 | 2305 |
| | Aug | 4224 | 1488 | 1933 |
| | Sep | 4030 | 1370 | 2192 |
| | Oct | 4136 | 1456 | 2167 |
| | Nov | 3614 | 1427 | 2142 |
| | Dec | 3845 | 1211 | 1844 |

| COHORT | | INITIAL COHORT STRENGTH | | |
|---|---|---|---|---|
| Year | Month | Two-year | Three-year | Four-year |
| 1970 | Jan | 4091 | 1391 | 1935 |
| | Feb | 2358 | 1319 | 2313 |
| | Mar | 820 | 964 | 2204 |
| | Apr | 793 | 899 | 1969 |
| | May | 1020 | 854 | 1653 |
| | Jun | 1815 | 999 | 2656 |
| | Jul | 2026 | 1211 | 2533 |
| | Aug | 2601 | 1410 | 2671 |
| | Sep | 2455 | 1331 | 2596 |
| | Oct | 1539 | 832 | 1932 |
| | Nov | 1425 | 701 | 1744 |
| | Dec | 1415 | 583 | 1553 |
| 1971 | Jan | 2080 | 838 | 2072 |
| | Feb | 1728 | 725 | 1884 |
| | Mar | 1502 | 596 | 1592 |
| | Apr | 1360 | 587 | 1576 |
| | May | 1187 | 509 | 1412 |
| | Jun | 1575 | 781 | 2268 |
| | Jul | 2154 | 685 | 2417 |
| | Aug | 2286 | 594 | 2400 |
| | Sep | 2415 | 565 | 2167 |
| | Oct | 1981 | 460 | 1816 |
| | Nov | 1542 | 431 | 1575 |
| | Dec | 1294 | 426 | 1640 |

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**12. SPONSORING MILITARY ACTIVITY**
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**13. ABSTRACT**

Data from Marine Corps enlisted cohorts are analyzed to give insight into personnel flow through the enlisted Marine Corps system. In this paper, a cohort is a group of enlisted men who enlist in a given calendar month for a given length of obligated service. Stationarity assumptions between cohorts from different months are investigated. A major portion of the analysis is devoted to the extrapolation of the incomplete data on four-year enlistees based on the data from two-year and three-year enlistees. A prediction is made of enlisted strength for 1 January 1972 using the results of the analysis in a cohort prediction model. This is compared with the actual strength as of 1 January 1972. Refinements and associated models are suggested for further study.

| KEY WORDS | LINK A | | LINK B | | LINK C | |
|---|---|---|---|---|---|---|
| | ROLE | WT | ROLE | WT | ROLE | WT |
| Marine Corps | | | | | | |
| Manpower | | | | | | |
| Personnel | | | | | | |
| Prediction | | | | | | |
| Cohort Models | | | | | | |
| Cohort Data | | | | | | |